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East Europe Report

SCIENTIFIC AFFAIRS

No. 726

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This serial report contains press and radio coverage on the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences.

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POLISH-SOVIET AIR RADAR GEOLOGICAL SURVEY CONDUCTED

Warsaw SKRZYDLATA POLSKA in Polish No 43, 25 Oct 81 p 3

[Article by Pawel Elsztein]

[Text] By now we are capable of defining the structure of distant planets in our solar system. Among others, radar has thoroughly explored the moon from the earth's surface as well as from the lunear orbit, and special maps have been produced. No wonder that experience gained in space techniques have been transferred to the Planet Earth. Thus, in addition to taking pictures of the earth's surface by using various passive systems more often active observations are applied such as the use of 0.5 cm to 10 m long radiowaves of electromagnetic radiation reflection emitted from a spacecraft or aircraft. Advantages of radar are obvious: its waves penetrate cloud covers and fog. They can be used by day or by night. In some cases they can also penetrate vegetation and certain weathered rock. The image obtained by radar presents a "clean" earth's surface, without deformations cuased by the above mentioned obstructions. It renders perfectly the sculpture of the earth's surface.

We have been well informed about the newest technical progress, however only 2 years ago a decision was taken at the suggestion of the President of the Central Geological Office to start tests on Polish territory. There was the question of laying out radar images of three selected areas of 300 to 400 square kilometers. Such images would help initial geological discoveries. Since in Poland we do not have necessary equipment nor "radar" specialists, we have contacted a Soviet establishment which informed us that the making of such three separate images would be costly. Therefore, the decision was made to make radar images of nearly one-half of the Poland's territory, using an An-24 plane. Radar waves covered an area of nearly 120 thousand square kilometers of southern Poland. Some 8 to 15 thousand square kilometers were scanned per day. The southern regions were selected because the bed-rock there is relatively shallow.

The An-24 Soviet aircraft was equipped with the Soviet TOROS radar equipment, which is used by the surveying enterprise and is one of the many of this kind existing in the USSR. The resulting large series of radar images gave us a basis for geological interpretation. Much information has been obtained from the region of Swietokrzyskie Mountains, Sudetes and Carpathians. Assistant Professor Dr Joseph Bazynski, manager of the Air and Satellite Photographic Interpretation Center of the Geological Institute supplied information on the radar map of that part of Poland which was produced in this Center.

The aim of Polish specialists was to gain a full documentation of Poland "from bird's eye view" by using black and white photos and multi-spectral as well as radar images. Surveys can be made only under good weather conditions, otherwise an air group would have to spend much time for such kind of work and the cost would be high. Therefore the radar method had to be used exclusively. A question is raised how high were the expenditures for radar pictures of the one half of Poland. According to information obtained, the cost of the whole undertaking, including the making of pictures as well as of their laboratory processing, provisions for the operating personnel, etc, worked out to less than the cost of one single deep geological drilling!

Evidently, radar images do not give an immediate reply that here or there crude oil will be found, and that there are new deposits of copper or gold. The radar method gives intermediate information. It is one of the many methods used by geologists. Selected images of the Swietokrzyskie Mountains and Sudetes have been submitted to special measures, such as electromagnetic wave detection from various elevations and four directions of approach. Such method secured one hundred percent of the obtainable information. (Pictures from one direction provide up to 70 percent of information). These pictures have been interpreted by geologists and, on this basis, a map was prepared on a scale of 1:200 thousand, on which all geological information has been entered. Practically, it is a topographical map with overprinted data.

Work on the map was finished this year. A good recognition of the investigated area has been obtained. For example, an interesting configuration of rock was detected in the Sudetes. Results of investigation are used in serial production of geological maps. It is hard to go deeply into details accessible to specialists, but one is certain, that radar technology together with the airplane broadened our knowledge on the geological structure of our country. Moreover, next to the USSR, we are the first CEMA country to carry out radar detection on such a large area. The radar map was realized due to the efforts of an ambitious team headed by MS Michal Wilczynski and his coworkers, which included: MS Stanislaw Doktor, MS Marek Graniczny and MS Adam Sieradz. To be added is the name of Vladiliy Starostin, consultant from USSR, whose cordiality and helpfulness to our needs was highly appreciated in Poland.

Radar maps have been distributed to geologists. Only they will appreciate the usefulness in testing in terrain the information contained in those maps. The first evaluation of maps by teams from Krakow and Wroclaw is favorable. We would be happy if satellite pictures and radar images could enable us to reach all the riches in which, according to geologists, our Polish land abounds.

9841
CSO: 2602

BRIEFS

HUNGARIAN-SOVIET COMPUTER CONTACT ESTABLISHED--Permanent computer contact between the Hungarian Academy of Sciences and the Leningrad computer center of the Soviet Academy of Sciences was established on Thursday by Hungarian and Soviet specialists. For years there has been successful collaboration in developing and establishing computer networks between the various institutions of the Soviet Academy of Sciences and the Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences. This collaboration is part of the joint work performed in the interest of establishing an international computer network between the scientific academies of the socialist countries. The fact that a permanent connection via rented telephone line was established between the Budapest and Leningrad computer centers is an important milestone in this collaboration. Among other things, this will make possible exchange and joint development of research findings, information and programs. It will also permit computer assisted tele-editing of the joint periodical of the two academies and use of the computerized graphics system which aids engineering planning. The ultimate goal of the collaboration is establishment of international computer networks which will raise the level of scientific cooperation and exchange of information to new, far higher levels than were possible previously. [Text] [Budapest NEPSZABADSAG in Hugarian 4 Dec 81 p 5 WA]

CSO: 2502/31

WORK OF PHARMACEUTICAL CONTROL LABORATORY DISCUSSED

Tirana ZERI I POPULLIT in Albanian 18 Nov 81 p 3

[Article by Idajet Zotaj, director of the Laboratory for the State Control of Pharmaceuticals in Tirana: "An Important Center for the Protection of the Health of the People"]

[Text] Little is known about the Laboratory for the State Control of Pharmaceuticals but, as an institution specializing in the control and analysis of pharmaceuticals, it carries out an important function. Today it has been transformed into an important research center in the field of analysis of pharamceutical products.

One of the main duties of the scientific research in our laboratory is the elaboration of methods for the qualitative and quantitative analysis of medicinal products through the use of chemical, physical-chemical, microbiological and biological methods. In light of the fact that, mainly, imported pharmaceuticals, raw materials and prepared products are analyzed, great efforts are made to assimilate and utilize the latest methods which are being used in the world today.

Since the pharmacists who graduate from our faculty are generalists, all advanced cadres who begin work in the control laboratory undergo a period of specialization in the laboratory or in other institutes, for 1 or 2 years, depending on the area of specialization. For example, the period of specialization in chemical analyses in this laboratory last a year. For analyses of medicinal crops, the specializations lasts 2 years, including 1 year in the department of botany. Also, the period of specialization in biological and microbiological analyses, which takes place in the Institute of Hygiene and Epidemiology and in the laboratory, lasts 2 years. Special attention is given to the training of intermediate cadres.

The scientific studies in the laboratory are concentrated on the study of the qualities of domestic raw materials for pharmaceutical use. There has been research on the active material content of our crops and there has been cooperation on several themes with the department of botany of the Faculty of Natural Sciences, with the Institute of Military Medicine Studies and with the department of pharmacy of the Faculty of Medicine. Nevertheless, the lack of a coordinating center for the study of crops is felt. Much has been said and written about this matter but so far no solution has been found.

For several years the Laboratory for the State Control of Pharmaceuticals has studied the quality of some chemical products of our industry, some of which, upon

its recommendations, have been removed from the import list. A success of our chemical industry was the production of nitrogen protoxide for anesthesia; it has been used in our operating rooms. Workers in the laboratory have made a contribution to the production of this gas, participating in the preparation and implementation of technical conditions for analysis. However, we think it is necessary to set up a joint working group of chemists and pharmacists to study more thoroughly the health requirements of articles which might be produced.

In cooperation with the rubber factory in Durres and the glass factory in Kavaje, research is being conducted and quality standards are being drawn up for the rubber and glass for pharmaceutical packaging which will be used in the antibiotic factory and for laboratory vessels.

Another matter studied by the laboratory was the period of potency of medicines. In the last 5-year plan, special attention was given to the stabilization of medicinal preparations and materials. The solution of this problem is also of great economic importance because millions of leks are saved by the proper determination of the period of effectiveness of the substance and by the extension of the period of potency and the time during which the drug can be used.

At the same time, the laboratory gives technical assistance and direction to the work of nine laboratories for pharmaceutical analyses in the districts. All cadres assigned to work in these laboratories have had a period of specialization in the Laboratory for the State Control of Pharmaceuticals. In our institution cadres from sectors outside the health sphere have also had training in some new methods of analysis. These cadres come from sectors in which these methods are used such as industry, toxology and others.

We have given special attention to scientific information. Pharmaceutical reviews with the latest scientific news from various countries of the world are received in our institution each month. Also, the filing of all articles dealing with these subjects has enabled us to introduce new elements in science into our everyday analyses and to improve their quality.

The continuation of research for the improvement of existing methods and the perfecting of new methods of analysis are duties which we have set for ourselves in the future.

CSO: 2102/2

BROADER COOPERATION SEEN NECESSARY FOR ACHIEVEMENT OF SCIENTIFIC GOALS

Tirana BASHKIMI in Albanian 20 Nov 81 p 2

[Article by Ajet Ylli, secretary of the Committee for Science and Technology: "The Technical Sciences Are Confronted with Great Tasks"]

[Excerpts] The tasks facing the technical sciences are stated in the five-year plan for scientific research work which is a component part of the overall plan for the economic and cultural development of our country.

Important studies are planned in the area of ore prospecting and extracting and in the area of the improvement of the technology of the production and processing of ores in the country. The aim of these studies is to find the best way to utilize compltely all the useful components of raw materials, at the lowest cost and with the best quality products. The increase in production during the 7th five-year plan will be 56-58 percent higher than during the past five-year plan. This increase is predicted on the basis of studies which will be made to find the most profitable ways to introduce and disseminate additional methods for raising the coefficient of extraction of petroleum from existing sources. Also, studies and designs will continue to be prepared in regard to the extraction and enrichment of solid ores. Special importance will be given to the enrichment of chrome ores with the aim that 50 percent of the chrome ore will be enriched by the end of the five-year plan. Studies associated with the discovery of methods to enrich poor ores, which are currently not being utilized, will receive special attention. The studies and experiments which will be carried out in the machine sector will be geared to the improvement of the mechanization of the work processes and the production of the most varied types of equipment for complete industrial lines and projects.

The achievement of these objectives requires that all responsible organs, both at the grassroots and at headquarters, give greater attention to the guidance and organization of scientific research work.

First of all, we must work so that the most talented specialists and scientists work in all organisism, from the technological bureaus to the various scientific institutions; these should be people who have given evidence of their theoretical assimilation of the contemporary achievements of science and their practical application.

In order to improve the quality of the studies and designs it is important that great effort be made to ensure continuity in the research and design work of the specialists. The best form of training is to study and design projects together with and under the direction of comrades who have experience. Therefore, it is necessary for the best specialists in work groups who have been skillful in solving problems to be assigned to other groups and not, as has happened in some cases, be dispersed without being given any other tasks.

The advanced professional training of high level specialists will continue in a more organized manner in this five-year plan and this will help to raise the level of studies. Short term training, lasting 2-3 months, has begun in all central departments, in accordance with the plan. Also, long term post-graduate training, lasting 2-3 years, is in the planning stages and it has begun to resemble a regular educational process. However, this activity is not progressing well everywhere. The matter of 2-3 month training is not given the proper attention by some central departments, by their cadre directorates and the work is limping along in those departments where it has been begun and in many other departments it has not been begun yet.

Many themes planned for enterprises, executive committees and ministries and for the nomenclature of the Council of Ministers cannot be studied solely with the forces of the enterprise, district or ministry. They have been planned for broader cooperation. For this reason, from the very beginning of the scheduling process, it is important to parcel out the tasks and to ensure that each party takes responsibility for the part which is assigned to it. The investigations made during recent months by the Committee for Science and Technology show that in regard to a number of subjects on the nomenclature of the Council of Ministers this collaboration has not been accurately stated, especially in regard to some topics belonging to ministries which collaborate with the Academy of Sciences and Tirana University.

Greater attention should be shown for the further perfection of the method of completing all phases of studies. Research, design and execution work should be a continuous process and no interruptions should be permitted. Special importance should be given to the design phase which is a transition from general study to concrete realization. In particular, accurate design work in the fields of machine building and technology should overcome its relative backwardness in comparison with design work in the field of constructions, in general and hydro-electric power plant construction, in particular. From the beginning stages, our studies should be accompanied by economic and financial studies. The latter studies should give a better presentation of the most important indicators which should be achieved, such as labor productivity, effectiveness of expenditures, etc.

CSO: 2102/3

REPORT ON DEVELOPMENT OF NEW INSTRUMENTS, TECHNOLOGIES

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian
No 2 81 pp 75-80

[Text] Method for Stabilizing Unprocessed and Purified Alkaline Protease

At the Institute for Organic Chemistry in collaboration with the Center for Phytochemistry at the Bulgarian Academy of Sciences, invention #41701 has been designed by a group of inventors headed by P. T. Nedkov, senior scientific coworker, with the participation of co-inventors from the Economic Chemical Factory in Botevgrad. The invention relates to a method for stabilizing unprocessed purified solutions of alkaline protease, an enyzme widely used in flavor preservation, textiles and other industries. With the application of this method the compound does not have to be dried, and this reduces the inconvenience of current methods; the danger of protease is reduced when it is used in the textile, leather, cheese and other industries as well as popular chemistry because the new compound is not dusty and is not inhaled by workers; working with alkaline protease is easier: instead of having to weigh out the powdered alkalin protease and dissolving it (the unprocessed preparation is difficult to dissolve), the necessary amount of enzyme can simply be poured out. During stabilization of protease according to the invention it is unnecessary to dry the enzyme solution, and stabilized alkaline protease retains a higher degree of activity at room temperature and at elevated temperature (45^{o}C) than if only sugar or only glycerin is used. The end product obtained by the method cost less than half the comparable price.

The invention is used in the production of alkaline protease, for its stabilization in solutions and preservation of these solutions for long periods at normal temperature (at 22^{o}C for 1-2 years).

Method for Producing Perylene Biopreparations

The method represents invention #43973 of Institute for Organic Chemistry and the Center of Phytochemistry at the Bulgarian Academy of Sciences. The inventor's group was headed by P. T. Nedkov, senior scientific coworker, with the participation of co-inventors from the Ministry of the Chemical Industry. The invention relates to a method for producing powdered perylene biopreparations by direct mixing of bacterial alkaline protease, stabilized in

solution, with detergents. Advantages of the method: loss of activity is greatly reduced when the enzyme comes into contact with the detergents; the loss of enzyme activity in one month's storage of perylene compound prepared according to the invention is 1/4 of that of the compound prepared from powdered enzyme, and is equal to that of capsular enzyme. The additive which is added to alkaline protease stabilized in solution within the limits of the invention has another positive effect in addition to stabilizing the enzyme. At room temperature for 10-15 days it esterifies the low fatty acids present in the enzyme solution and thereby improves the handling and application of perylene enzyme preparations.

This invention is used in the production of powdered perylene biopreparations. It has been put into serial operation at the Economics Factory for General Chemistry "Verila" (Ravnopole) and can set up at other enterprises involved in the manufacture of dry perylene preparations.

Agent for Diluting Ovine Seminal Fluid "Zlatno Runo"

The development of the Institute for Biology and Immunology of Replication and Development of Organisms at the Bulgarian Academy of Sciences is protected by patent No. 25829/1979, St. T. Zlatarev, scientific coworker, is the inventor of name.

The agent for diluting ovine seminal fluid hitherto used in our practice (glucose-phosphate diluent) maintains the biological properties of sperm for about 2-3 hours at 18-20^{o}C. This extremely short storage life does not provide ample opportunity for efficient use of this genetically most valuable breeding tool.

The agent proposed in the invention is comprised of citrate buffers and contains substances which induce temporary inhibition of the metabolic process in sperm by altering pH and storage temperature. These altered properties make it possible to retain the full-valued biological qualities of ram sperm for 24 hours, which is the great advantage of "Zlatno Runo" diluent. Application of "Zlatno Runo" diluent makes possible to establish new arrangements for artificial insemination of ewes in which the amount of impregnating agent used is reduced by 50%; the genetically most valuable impregnating agent can be used; savings of the agent are realized; improvement of ovine herd stock is accelerated.

The invention is used in animal husbandry and sheep breeding. The agent is manufactured by the Pharmakhim State Economic Association. The Scientific-Industrial Association for Cattle and Sheep Breeding has prepared instructions for its use, as well as research protocols for organizing artificial insemination of ewes using transported and stored seminal fluid.

The development has been introduced in the Razgrad, Khaskov, Pernisha, and Vrachan okrugs. Its introduction throughout the country is planned when conditions are right for its use. Introduction of new "Zlatno Runo" diluent in practice yields great savings: calculated on the basis of 20,000 ewes, savings for the first year are 160,000 levs. With expanded introduction, the effect will be greatly multiplied.

Automation of Technological Process in Potable Water Purification Station

In the development of this scientific-resesrch task at the Institute for Water Problems patent #38517 "Control device for self-acting gravity-fed high-speed filters" and patent #43180 "Regulator for self-acting high-speed gravity-fed filters" have been created by the inventor group: prof. P. Ignatov, N. Koev, senior research coworker and R. Ognyanova, scientific coworker.

The control devices operates on the ejector principle and is simple in design, small in volume and failure-free in operation. It can be constructed without mechanical transmissions or support connections, and uses materials with negligible ageing.

The regulator operates according to Archimedean and Pascalian principles; it is distinguished by its simple technological design and failure-free operations and requires no field connections.

The invention is used in water management (in the Committee for Architecture and Public Welfare system), Economic board of directors of "Vodosnabdyavane", "Vodokanalproyekt", etc), and other fields of hydraulic technology. Laboratory models, pilot plant tests and introductory plans have been sent to the "Igralishte" and "Borovets" purification plants. Industrial production has been arranged with disclosure of a multiplication effect.

Pulsed Galvanostatic Complex Type G 105

A team from the scientific working group at the Institute for Physical Chemistry headed by engineer M. Athansov, scientific coworker, has developed a pulsed galvanostatic complex G 105 for performing stead-state and pulsed galvanostatic measurements in electrolytic solutions. The design of the complex of the device G 105 permits it to be used for electrochemical and corrosion studies; the method of steady-state polarization curves, the method of current switching (basic galvanostatic method or method of cascade-type current change), the method of current cut off (voltage reduction), the dual pulse galvanostatic method, the method of current polarity alternation, cyclic galvanic method as well as thechromopotentiometric method. It will be possible to preselect an arbitrary sequence of polarization conditions (8-position program) which can be automatically reiterated many times. It will also be possible to provide semi-automatic compensation for resistive voltage loss in electrolytes.

The pulsed galavostatic complex G 105 is noted for its very high speed and accuracy. With the aid of the complex all kinds of jobs can be tackeled: the study of the mechanics and kinetics of slow and fast (with velocoty constants up to 100 m/s) electrode reactions and corrosion processes, the investigation of the double layer structure and adsorption, the development of conditions for electrocrystallization and electrorefining of metals, etc.

The G105 complex can be used to tackle various problems in analytical chemistry.

The equipment consists of the following: high-speed galvanostatic G 105 G with automatic voltage range selection; G 105 P programmable device; G 105 B dual pulse generator with galvanostatic output; G 105 A recording adapter;

G 105 Ya electrochemical cell.

Technical specifications: polarization current ± 1 nA-1A; maximum polarization voltage +150 V/15 V at 1A; program steps 8: duration of steps: 1 microsec to 10^4 sec; rise time 0.1-1 microsec; accuracy: amplitude 0.1% and time 0.1%; residual current up to 1 nA and operating conditions: single + cyclical.

Pulma 80 Automated Microprocessor System

The development is the property of the Central Laboratory for Biophysics at the Bulgarian Academy of Sciences headed by G. Georgiev, senior scientific coworker, and is for studying human respiratory functions. Pulma-80 performs up-to-date studies, using standard methods, both under conditions of mass screening of respiratory functions; under clinical coniditions it reveals the earliest preclinical and presymptomatic disorders of respiratory function, as well as incipient changes with a view toward the prevention, outpatient treatment and management of functional disorders of the respiratory system.

Pulma-80 is a fully automated open pneumo-tachometric system which useds the latest advances in microcomputer technology and specialized programming. It is a miniaturized portable system whose size and weight are comparable to a portable typewriter. Its indicators of ventilation make it convenient both for various purposes of prevention (various screening and epidemiological surveys) and for routine exminations of respiration under clinical conditions. Some of the indicators are being utilized for the very first time in world practice. In terms of the number of parameters it measures, reproducibility, software and hardware, the Pulma-80 automateed system is ranked at the average world level and in terms of technical and economic indicators, it rivals similar equipment manufactured by Western companies. This is the first development of its type in our country and in the universal computer system.

The system's programming support and operating routines are written to ensure optimum research effectiveness and man-machine interaction. The system's ergonomically planned operating routine maximally facilitates the operator's job and permits iterative man-machie addressing. When using this approach to organize systems functions, the operator's activities and technical sequence are governed by the program and the possiblity of error is significantly diminished.

Pulama-80 system monitors 18 variables of the volumetric flow rate in ventilation. To determine the preset levels of the studied indicators, and to compute their percentage deviation from normal for each test subject, the program contains common and the most widely used formulas for defining normal values of anthropometric characteristics.

Pulma-80 affords the examiner the maximum operating convenience and high precision in determining test variables. The basic advantages of the system include: rapid, failure-free operation, simple maintenance; automatic selection of optimum results; direct data display; mini-printout from display of abnormal deviation of test indicators; automatic zero correction; automatic correction of test indicator values in terms of physiological standard; mneumonic display of maintenance instructions and messages, etc.

Introduction of the development into the health care system will result in both social and health effects, providing an opportunity to carry out screenings of respiratory functions of specific insured population groups and use in routine clinical diagnostics of functional respiration.

Spektroskan 180 A High Speed Scanning Spectrophotometer

The Spektroskan 180 A high speed scanning spectrophotometer was developed by the Scientific-Industrial Laboratory of High Speed Spectrophotometry and Biophysics (NPLSSBF) at the Bulgarian Academy of Sciences, headed by Yu. Vasileva, senior scientific coworker. It is a mass-produced instrument of the family of high speed scanning spectrophotometers with analog recording of spectrophotometric data, and is used to study the absorption spectra and their dynamics in high speed processes.

Spektroskan 180 A makes it possible to conduct scientific research of processes in the near UV and visible light at 230-800 nm. Resolution of the device is 1 nm or 2 nm according to the diffraction grating employed (1200 or 300 lines per millimeter). Dead time of the current device is less than or equal to 2 milliseconds. Spectral data are converted by a disector type photoconverter. Data are displayed and recorded on a C 8-13 memory oscillograph.

Spektroskan 180 A contains two patented devices, #23460 and #24180.

This scientific and technical advancement has been introduced at the NPLS-SBF at Bulgarian Academy of Sciences.

Spektroskan 180 E High Speed Scanning Emission Spectrophotometer

The high speed scanning spectrophotometer, Spektroskan 180 E, is a product of the Industrial-Scientific Laboratory of High-Speed Spectrophotometry and Biophysics (NPLSSBF) at the Bulgarian Academy of Sciences, headed by Yu. Vasileva, senior scientific coworker. It is an optical spectral device for studying the technical emission spectra of processes in the visible and near UV regions 230-800 nm. The device provides resolution of 1 nm with diffraction grating having 1200 lines/millimeter and 2 nm with a diffraction grating of 300 lines/millimeter. Photometric precision is 2 percent. Spectral information is converted from the optical spectrum to its electrical equivalent using a disector type photoconverter. Scanning is sequential periodic. Maximum scanning rate is 7.5×10^6 nm/second.

The scientific and technical advancement Spektroskan 180 E has been introduced at the NPLSSBF at the Bulgarian Academy of Sciences and the Academy of Sciences of East Germany.

8617
CSO: 2202/4

'NETWORK I' INTRODUCED IN CEMA COMPUTER SYSTEM

Sofia TEKHNICHESKO DELO in Bulgarian3 Oct 81 p 2

[Article by Y. Aleksiyeva, engineer]

[Text] Bulgarian participation in Hall Number 8 of the fall trade fair in Plovdiv, dedicated to automation of institutional activities, was impressive. Many exhibits were being shown for the very first time and the attention they attracted was fully merited. The "Network I" system is a typical example. It was developed by the experts at the Institute for Computer Technology (IIT). The programming support was developed at the same institute, in the "Multicomputer networks and systems" section headed by Emil Dimitrov, engineer. It is the first development intended for the CEMA computer system.

"Network I" is a multimachine complex of computer hardware and programming support. It connects the country's existing territorial computing centers, thus producing a unified computer network. In that way a very wide range of scientific and technical, economic, informatics and other problems can be tackled. This first version the system consists of three SM 4 minicomputers. A YeS 1022 central processor is connected to each one. The three SM 4 machines are interconnected via dedicated telephone lines. The transmission of data, instructions and programs is synchronous full duplex. This is accomplished using SM 8507 synchronous modems with rates of up to 9600 baud. The YeS 1022 and SM 4 are locally connected via the IZOT 4500 S system interface. The standard configuration of YES computers permits inclusion of ESTEL system hardware.

Specialists who became interested in the new "Network I" system, be they from enterprises, plants, institutes, ministries, keep asking questions about the major technical specifications. Here are some of the answers: maximum number of terminals which can be connected to the YeS 1022 is 64; maximum number of terminals connected to one SM 4 minicomputer junction is 16; data exchange rate between junctions and YeS 1022 is 300 Kbaud; rate of transmission between one terminal and YeS 1022 computer is 2400 baud.

During the trade fair three SM 4 computers were powered up: one destined for IIT/Sofia, a second in Hall 16 "System '81" and a third one, of course, in Hall 8. The information that could be obtained at a moment's notice by the specialists was related to the latest developments of the institute represented at the exhibition.

This is not the "Network I" system's first success . It was earlier demonstrated at the XII Party Congress. There not only specialists but other interested parties were able to obtain information on the status of industry in the Sofia, Plovdiv and Vrachan okrugs. Information which would have taken days to exchange if it were carried by the postal service.

8617
CSO: 2202/3

PRODUCTION CAPACITY OF COMPUTER INDUSTRY OUTLINED

Sofia TEKHNICHESKO DELO In Bulgarian 3 Oct 81 p 13

[Article: "The IZOT State Economic Association"]

[Text] The production of computer and management technology in Bulgaria is handled at 14 large plants and 4 scientific organizations belonging to the State Economic Association "IZOT" and another 120 plants from other subsectors of mechanical engineering, on the basis of high specialization and cooperation of industry.

The product list of the "IZOT" association includes peripheral magnetic disk and tape memories; digital electronic computers to meet domestic and export requirements; analog electronic computers; systems for processing economic data and production management data for both the domestic market and for export; electronic cash registers for business etc.

The development of computer technology in the "IZOT" association is based on thorough scientific research and design and planning work. The main effort is focused on three areas.

First and foremost is the development and improvement of medium-size problem-oriented complexes. The hardware of this complex is designed to use matrix processors and hierarchical memory structures including high-speed ROMs and RAMS which can be interfaced with peripheral magnetic disk, magnetic tape memories, and data bases. This will involve a rapid acceleration in remote processing and reinforcement of system network architecture, and improvement of the variety of modular terminals.

The second focus is related to the creation of new large-capacity magnetic disk peripheral memories, magnetic tape memories with phase modulation, automatic tape sequencing and block encoding of data.

Special attention is also being given to floppy disk and diskette memories to be used as basic components of of microcomputer systems.

The third focus is the continuing development of problem-oriented mini- and microcomputers systems. Microcomputer base modules are designed and constructed from microprocessor complexes. Using different combinations of standard base modules, a wide variety of computer capacities and specifications can be configured to the specific requirements of the user. Outfitted with the proper hardware for planning and development of programming

support, microcomputer systems will become an all-purpose means for automation and intellectualization of material production.

The ever widening use of microprocessors is leading to the creation of hardware noted for its high reliability, miniaturization, all-purpose functional resources and high efficiency. This is a requirement for solving the problems of total automation and electronization of the national economy by means of the widespread adoption of computer technology in various fields of life. The certain successes of the 7th Five Year Plan are a prerequisite for achieving even greater results in production and foreign trade activity in the 8th Five Year Plan.

8617
CSO: 2202/3

BRIEFS

COMPUTERIZED FODDER RATIONING SUCCESSFUL—During the past 3 months, technicians have been experimenting with a computerized livestock feeding system at the Sumava state farm's dairy in Chvalsina. A collar containing a microprocessor is attached to a cow's neck, signaling at specific times a grain fodder rationing machine to issue a grain fodder ration previously determined by an individual cow's milk yield. A miniprocessor simultaneously records each issued ration. The system enables zoo technicians to evaluate each cow's grain fodder consumption, health condition and milk yield on a daily basis. So far 30 dairy cows have participated in this program, but all of the dairy's 300 cows will be involved by spring of 1982. The system reportedly saves up to 14 percent of grain fodder consumption and increases milk yield 15-20 percent. [Prague ZEMEDELSKE NOVINY in Czech 4 Dec 81 p 1]

CSO: 2402/11

BULGARIAN COMPUTER EQUIPMENT FOUND RELIABLE

Budapest SZAMITASTECHNIKA in Hungarian Jul-Aug 81 p 21

[Text] Bulgaria is a well-known shipper of computer equipment to the Hungarian market. It delivers complete computer systems, a variety of peripherals, as well as data preparing equipment. To date, 14 ES 1020 B and ES 1022 B computer systems operate in Hungary in Budapest, Miskolc, Szeged, Gyor, Debrecen and Pecs. The Building Management and Organizing Institute [EGSZI] bought nine of the systems. Hungarian users operate the machines in three shifts. Experience has proved the Bulgarian machines to be reliable. This is due to the good quality of the products themselves, the high quality of service provided by the Izotimpex Foreign Trade Enterprise, the supply of components maintained in Hungary, and the competence of Hungarian users.

The ES 1035, the first Bulgarian computer belonging to the second ES series was recently put into operation at the Computer Technology Research Institute [SZAMKI]. The system has a very high rate of performance. It is equipped with 100 M-byte disc packs, semiconductor operative store, magnetic tape units, a new type of operating console and a virtual operating system.

To round out computer systems made in Hungary, a total of 400 SM-5400 minidisc units, as well as SM-5302, SM-5303 minitape units will be delivered. At present a large number of ES 9002-type magnetic tape data preparing devices are operating in Hungary. For the coming year-and-a-half, Izotimpex has offered Hungarian consumers numerous new products. These include the ES 1035 B computer equipped with ES 2335 matrix processor and modern terminals, as well as the ESTEL-4 transfer system; the SM-4 computer with high capacity peripherals which include a 29 M-byte magnetic disc unit; the INFOREG special purpose system.

Since many users of minicomputer systems lack knowledge of computers and programming, Bulgaria devised the INFOREG special purpose system [POK] for use with the SM-4. It is designed to manage a variety data generated in bookkeeping, libraries, hotels, schools, inventories, export-imports, administrative procedures, etc.

CSO: 2502/29

HUNGARY READY TO MAKE TELETEXTING EQUIPMENT

Budapest MAGYARORSZAG in Hungarian 8 Nov 81 p 32

[Report by Miklos Palos: "Teletext Starts Operation in July--Interest, Cost, Production Cost"]

[Excerpts] It has a Hungarian name already: tube news. Its foreign variations (teletext, videotext, caefex) were often used, and there were few people who believed that its translation into Hungarian would be so successful. It was presented in its experimental form to the Hungarian public at the most recent Budapest International Fair, showing its technical and essential possibilities.

In Hungary, the team at the Communications and Electrotechnical Institute of the Technical University worked for 3 years on the domestic model of the teletext. According to professor Pal Ferenczy, who led the study, this required the solution of many problems. One of them was, for example, to somehow substitute the Hungarian alphabet's discritical marks with structures according to the English system. The Swedish alphabet proved to be the best solution.

Since then, the Orion made the first prototypes on the basis of the study's results, and is prepared for mass production. The Videoton is also working on the so-called decoder necessary for reception; this decoder, when built into the TV set, makes it possible to "read" the tube news. According to a statement of the Videoton's chief of main department, they are planning to manufacture an apparatus which includes the unit necessary for the reception of the teletext program. One of the reasons the manufacturers are compelled to make these is that soon only such color appliances will sell on the western markets.

Regarding prices, industrial specialists are cautious, for the prices are mainly set by the demand for sets suitable for reception of tube news. (The latter also depends, of course, on the prices.)

Three Tasks

In the information received so far, we find that the Videoton set the price of the Munkacsy color TV set's modification at 15,000 forints, but the modification of the newest color sets costs only 8,000 to 9,000 forints. For comparison: in those western countries where sets suitable for telex reception are mass produced in excess of 100,000 units, the price of these sets are 15 to 20 percent higher than that of the conventional sets.

One of the domestic owners of the tube news will be the Hungarian Postal Service since it created the conditions for this technical service. We learned from the information given by Ferenc Valter, deputy director-general, that this will be the case in other CEMA-countries as well. We Hungarians were given the task of making a proposal for the selection of the most suitable system. This will be selected from the French antiop, the German bildschirmtext and the English models that are familiar in Hungary. The system selected should be suitable for a unified and long-time reception, for the decoder built into the sets has a life span of several years; it would thus be bad if they would become unusable after a few years because of another transmission technology.

For the operation of the tube news, 3 problems must be solved: that of the transmission, the reception technology and, last but not least, that of editing. While the first two are important technical problems the most significant problem is still programming, which is, first of all, an organizational and political task.

The type of mass communication that is being born in Hungary is owned and operated by the MTI. Its creation, according to Laszlo Agoston, deputy chief editor, is a fundamental political task, for the point is that this information service influences not only the individual but also the social attitude and public opinion. Through the tube news, people can get important information, and fast.

The MTI, in cooperation with 70 foreign agencies, its own correspondents in 21 countries, and the entire system of the domestic news service, works as a real "news factory." However, with the introduction of the tube news, even the present speed must be surpassed to adequately satisfy the demand of TV watchers and TV readers interested in the latest news.

According to the MTI, the realiztion of minute-by-minute news is not simply a question of speed. If, for instance, they want to give the addresses of pharmacies open at night, then they also must take care of giving the changes right away. Another example: even if they give traffic news only hourly, then they must have information suitable for broadcast within an hour of, say, a road closed at 3 P.M. because of surface damage. These examples show that the new means of giving information requires new methods. What is important is not only speed and dependability but also being concise. (The maximum length of teletext news is 3 and a half lines.)

The Basic Principle Is Speed

The perspectives of the practical use of the tube news are almost unlimited. This is shown by experience abroad. A sample of its use in the FRG: information on foreign and domestic politics, economy and sports, official notices, information on foreign travel, and cooking recipes are all included in the news appearing on the tube. Information on the acquisition of basic materials and on legal and other questions is directed to specific groups. Anyone may ask for information on certain conference deadlines and on table reservations in restaurants.

The time is not far away when, even in Hungary, the tube news will replace the housewife's cookbook or the traveller's time-table. Broadcasting will begin in July; there will be, no doubt, many people who will go through the tube news on the basis of "I just sit and ask."

9414
CSO: 2502/17

ISOLATION OF THE AUJESZKY'S DISEASE VIRUS FROM SWINE SEMEN

Budapest MAGYAR ALLATORVOSOK LAPJA in Hungarian Vol 36 No 8, Aug 81 pp 512-514
manuscript received 27 Feb 81

[MEDVECZKY, Istvan, Dr, SZABO, Istvan, Dr; Veterinary Medical University, Department of Epizootiology and Agricultural Cooperative of Mezohegyes, Department of Animal Hygiene]

[Abstract] To demonstrate the role of swine semen in transmitting infection, the Aujeszky's disease virus was isolated from the semen of naturally infected boars. Obtained from a state farm where all animals had been vaccinated against the disease and where the clinical form of the disease has not been apparent for 1-1/2 years, 13 samples from 11 boars were examined. The virus was isolated from the semen of three of the boars 4-6 months after their last vaccination. This is the first successful "in vivo" isolation of Aujeszky's virus from swine semen. Isolation, identification, pathogenicity of the virus and the neutralization test are described. An effective method is described to greatly reduce the cytotoxic effect of the semen. A slight toxicity of the seminal fluid remained after the first passages which usually disappeared after the second or third passage. The isolated strains are apparently moderately virulent wild viruses. Isolation of the virus from semen also confirms that serologically sensitized animals can excrete Aujeszky's virus in their semen. All 10 references are Western

2473
CSO: 2502/18

PASSIVE IMMUNIZATION OF FOALS TO PREVENT THE RESPIRATORY DISEASE CAUSED BY EQUINE HERPESVIRUS TYPE 2 (EHV-2)

Budapest MAGYAR ALLATORVOSOK LAPJA in Hungarian Vol 36 No 8, Aug 81 pp 525-527
manuscript received 9 Apr 81

[BELAK, Sandor, Dr, PALFI, Vilmos, Dr. BARTHA, Laszlo, Dr, TUBOLY, Sandor, Dr; Veterinary Medical University, Department of Epizootiology; National Animal Health Institute, and Agricultural Cooperative of Babolna]

[Abstract] Evidence points to the involvement of EHV-2 in the pathogenesis of the enzootic respiratory disease of foals. HEV-2 (KT/5797) was isolated from the nasal secretion of diseased foals and was grown on sheep-enbryonic kidney and calf testicle cell cultures, and the concentrated antigen was injected into adult horses to produce hyperimmune serum. The serum and the gamma globulin obtained from it were used to inject 10-day-old foals in two stocks where serious losses were caused by the disease in previous years. Of the foals, 16 received hyperimmune serum, 11 gamma globulin, and 9 were used as controls. During the first 6 weeks after immunization, the controls showed clinical signs of the disease, excreted virus in their nasal secretion, had specific virus neutralizing antibodies in their serum and one of them died. Most of the foals in the vaccinated group were free of symptoms or had only a slight fever. After 6 weeks, acute symptoms developed also in this group but the symptoms responded to brief antibiotic treatment. Serological tests showed that the passive immunity of vaccinated animals lasted 5-6 weeks. Subsequently, 15 foals received immunization twice, at 1-month intervals. These did not develop the disease. The experiments serve as indirect proof that the EHV-2 virus may play an initiating role in the respiratory disease of young foals and the disease can be prevented by passive immunization. References on request.

2473
CSO: 2502/18

EXPERIMENTAL STUDY OF THE ORGANOPHOSPHATE-ADSORBING EFFECT OF THE HAEMOCOL SYSTEM

Budapest HONVEDORVOS in Hungarian Vol 32 No 3-4, Jul-Dec 80 pp 245-249

[DAVID, Gabor, Dr, physician-lieutenant colonel, retired, candidate of medical sciences, SZKLENARIK, Gyorgy, Dr, physician-major, TAKATS, Gabor, Dr, scientific department head, HEGYI, Lajos, Dr, adjunct member]

[Abstract] Hemodialysis and hemadsorption are important in the current treatment of poisonings. A model experiment was set up with organophosphates to study the adsorbing capacity of the HAEMOCOL column. The technical details and clinical usage of the method are referred to in the bibliography. Dimethoate and Trichlorfon were used on a miniaturized "haemocol" column--prepared by the authors--to study their elimination from blood. Circulating blood volume, rate of flow, and mass of the column were proportional tc that used in human blood perfusion. Propylene glycol was added to the poisons to make them well miscible with fresh blood. The final blood samples contained 125 mg/ml dimethoate and 133 mg/ml trichlorfon, respectively. The phosphoric acid esters were determined by thin layer chromatography. Both phosphoric acid esters were rapidly adsorbed from the blood by the coated, activated charcoal granules. The kinetics of the adsorption is discussed. Reference 13: 3 Hungarian, 1 Russian, 9 Western

2473
CSO: 2502/20

STUDY OF PESTICIDE RESIDUES PERSISTING IN THE FAT, MUSCLE AND LIVER TISSUE OF CATTLE RAISED ON HOUSEHOLD PLOTS

Budapest MAGYAR ALLATORVOSOK in Hungarian Vol 36 No 9, Sep 81 pp 621-623
manuscript received 26 Feb 81

[SOMLYAY, Istvan, POSGAY, Judit, VARNAGY, Laszlo, Dr, SZIGETI, Tamas; University of Agrarian Sciences, Keszthely, Faculty of Agricultural Sciences, Institute of Plant Protection, and Veterinary Medical University, Department of Food Hygiene]

[Abstract] Export meat and large-scale animal farms have been under regular monitoring since the early 1970s. The current study involved animals raised on household plots and small farms. These represent a considerable fraction of the domestic meat supply. The samples were tested for their chlorinated hydrocarbon pesticide residues. Of the many pesticides tested, only DDT and its metabolites were present in higher than permitted levels in the fatty tissue samples (36.3-908.6 µg/kg found; a few were above the 500 µg/kg level permitted in Hungary). Residues of the HCH isomers were between 1.2-34.0 µg/kg, below the maximal allowable domestic and international levels. The elevated DDT values are attributed to the higher age of the animals on household plots which were still in a position to incorporate DDT before it was banned years ago. From a food hygenic aspect, the few objectionable samples are not considered to be hazardous. Reference 8: 7 Hungarian, 1 Western

2473
SCO: 2502/22

ACADEMY OF SCIENCES PERSONNEL, ACTIVITIES

Warsaw NAUKA POLSKA in Polish Mar-Apr, May-Jun 81

[No. 3-4, Mar-Apr 81 pp 193-206]

[Excerpt] I

From the Polish Scientific Activity

For the 100th anniversary of the Polish labor movement and the 15th anniversary of the Institute of Social Sciences of the Swietokrzyska Engineering College, the institute organized a symposium on the subject "The Working Class of the Kielce District." The symposium took place on 11 December 1980 in the town of Kielce.

The symposium program included reports on this region's workers' activities during the onset of the labor movement between the two world wars, under the Nazi occupation and in the postwar years. Reports were also presented on the activity of the Polish Socialist Party among the working class in the Kielce region during the years 1944-1948, on the revolutionary traditions of the working class in the Ostrowiec Swietokrzyski and also on the links between the industrialization and certain aspects of working class changes during the 6-year plan period of the Kielce voivodship.

Cooperation With the GDR in the Field of Higher Education

The Seventh Conference of the PSR-GDR Commission for cooperation in the field of higher education, linked with the conference of presidents of the cooperating universities of Poland and GDR, took place in Poznan 25 and 26 November 1980. Almost 30 presidents of both countries' universities participated.

Results of this educational cooperation have been positively evaluated. This cooperative program for the years 1981 to 1985 will be a step ahead in perfecting the quality and raising the efficiency of this cooperation.

The conference brought about an agreement on the cooperation between the PPR Ministries of Learning, Higher Education and Technique and the GDR Ministry of Higher and Professional Education. The agreement provides, among others, for cooperation in agriculture and alimentation, electronics and chemistry, as well as in other fields of exact and technical sciences. Furthermore, mutual work will be carried out in scientific research as well as in social and humanistic sciences.

The State and Perspectives of Investment Planning

An all-Polish symposium, organized by the Polish Economic Society (PES), in cooperation with the Szczecin PES Branch, took place 17 and 18 November 1980 in Szczecin.

Representatives of some 100 design offices from the whole country and all the economy branches took part in the debates. The aim of the symposium was the evaluation of the state of operation of units engaged in planning investments and in defining the direction and the form of their future activity.

The following reports were presented at the symposium: "Evaluation of the State and Possibilities of Planning in the Opinion of Economists" (Dr Eugeniusz Ostrowski), "Problems of Motivation and Interest of the Designer With Results of His Work" (MS engineer Wladyslaw Strusinski), "Determinants and Their Impact on the Designer as the Author of His Work" (MS Marian Domagalski), "The Economic Part of the Investment Project--Its Role and Significance Today and Tomorrow" (MS Joseph Pachnik), "Forms of Design Units Organization Against the Background of Conditions and Needs" (Dr Jerzy Walicki), "The Substance of Investment Project in the Light of Practice and Needs So Far" (MS engineer Zbigniew Dabrowski) and "Problems of Internal Economics and Evaluation of Design Office Work" (MS Elzbieta Makowiecka).

The discussion resulted in a decision accepted and presented to the Commission for the Problems of Economic Reform.

Policy and Management of the Economy

The Polish Society of Political Sciences organized in Radom from 27 and 29 November 1980, an all-Polish session on the subject "Policy and Management of the Economy." One hundred thirty scientists from all academic centers in the country took part in this session.

The program of the session included 17 reports discussed in 3 problem sections.

Professor Artur Bednar, president of the society, opened the meetings. Referring to the present political and economic situation in the country, he emphasized that this session was an attempt to find a reform of the present economic system. Next the president of the engineering college (WSI) in Radom, Professor Michal Hebda, presented an outline of instruction at the Radom College and the trends of scientific research conducted there.

The members of the Policy and Management of the Economy in a Microregion Section, chaired by Assistant Professor Dr Andrzej Piekara from WSI, discussed existing links between the performance of political and economic institutions on the local level and also problems connected with centralization and decentralization as well as self-government on the level of the commune and the individual.

In the Policy and Economy Management in a Workshop Section, chaired by Assistant Professor Dr Czeslaw Surownik from the Lodz University, the leading

discussion subjects concerned employment policy, the role of the trade union Solidarity and professional unions, self-government in work enterprises and also problems of culture and ethics as well as the problem of working class consciousness.

The Instructive and Educational Group of Political Sciences of the Ministry of Education, Higher and Technical Schools (MNSzWiT), under the chairmanship of Professor Artur Bodnar, discussed the preparation of a new subject to be introduced in the new school year at all schools of higher education; namely, the science of politics. This subject has been already discussed during recent years, drawing attention to the necessity of eliminating a multiplicity of trends.

It has been decided, among others, to start studies on the political system in Poland, taking into consideration the new political events. A resolution has been presented, concerning the reform of the political system of the Polish People's Republic. The Polish Society of Political Sciences announced the preparation of an extended report, which will include substantial propositions to improve the political system in Poland. This report will be presented to the central authorities of the party and the government.

Colloquium--Opole 80

The Colloquium--Opole 80, devoted to problems of comprehensive development of the Odra River and its basin, took place 21 October 1980. It was organized at the initiative of the Silesian Institute. Almost 40 scientists from research institutions of Szczecin, Wroclaw, Katowice, Warsaw and Opole participated.

The introductory report of the institute director, Assistant Professor Dr Boleslaw Reiner, was the basis of discussion; he presented problems of the socio-economic development of the Odra River basin, according to the program of the Silesian Institute's studies. In addition, eight reports were discussed in two sections: economic and social.

Problems of Map Production

On 28 and 29 November 1980, the Association of Polish Geodesists, the Geodesy Committee of the Polish Academy of Sciences and the Polish Geographic Society organized in Lublin a scientific and technical conference devoted to the improvement of map production. Nearly 100 persons, specialists in geodesy and cartography, photogrammetry and geography and also "informatics," from all scientific, university and technical college centers as well as geodesy and map-drawing units, participated in discussions.

Twenty-eight comprehensive scientific and technical reports and communiques, covering all problems, were presented, all linked with the performance of production processes, with the final result of maps and geodetic-cartographic documentations.

13th Symposium of Mathematical Physics

The 13th Symposium of Mathematical Physics took place from 9 to 12 December 1980, in Torun. It was organized by the Nicholas Kopernik University in Torun, in collaboration with the Physics Committee of the Polish Academy of Sciences and the Scientific Society in Torun and also the editorial committee of the "Reports of Mathematical Physics."

Participants in the symposium included nearly 40 scientists, representing domestic and foreign scientific centers, from Czechoslovakia, GDR, GFR, Switzerland, Italy and USSR. Twenty-six reports were presented, concerning the newest achievements in mathematical physics and in certain branches of mathematics with an application in physics.

French Scientific Instrumentation

On 22 and 23 October 1980, the Polish Academy of Sciences, the Ministry of Education, Higher and Technical Schools and the French Agency for Technical, Industrial and Economic Cooperation (ACTIM) organized in Warsaw a symposium on French instrumentation for scientific research. Specialists from Poland and France participated in the symposium.

The subjects of reports included the technology of developing microelectronic systems, using lasers in scientific research, the extremely high vacuum technique, etc.

There was also an exhibit of installations, produced in France by 15 manufacturers.

Microwave Technique

From 27 to 30 October 1980, the Polish Academy of Sciences, the Association of Polish Electrical Engineers and the Gdansk Polytechnical Institute organized in Gdansk an all-Polish Fifth Congress on Microwave Electronics of the Solid-State Body (MECS). Specialists from several domestic and foreign centers took part in this conference, including those from France, Great Britain, Japan, the United States, Italy and USSR.

In nearly 100 reports and communiques, the newest achievements, development and application trends of the microwave technique--i.e., the technique of very high radio frequency in contemporary telecommunication--were reviewed.

An exhibition of microwave installations and subassemblies, developed in domestic centers engaged in research in this field, was organized during the conference.

SPE-80 Symposium

On 23 November 1980, an all-Polish Symposium of Energy Conversion, SPE-80, took place in Lodz. The subject of this symposium was "Steam-Gas Power Plants With Coal Gasification." The symposium was organized by the Provincial Scientific-Technical Committee for Power Engineering of the Chief Technical Organization

(NOT) in Lodz and the Institute of Fluid-Flow Machines of the Engineering College of Lodz, in cooperation with the Presidium of the Committee of Thermodynamics and Combustion of the Polish Academy of Sciences. The task of the symposium was the discussion of domestic and foreign experiences so far, in order to map in detail the directions of technical and research activities, as well as assignments leading to further perfecting energy conversion in Poland. Nearly 200 specialists from all over the country participated in the conference.

Reports and communiques, presented in plenary and topical sessions as well as in visual exhibits, demonstrated that energy conversion by coal gasification and the use of gas-steam power plants will enable a considerable cost reduction of electric energy generation and at the same time will permit using low-calorie fuel, high-sulfur coal and even certain waste material without using costly refining equipment.

Discussions took place in two plenary sessions and in four topical groups. The need for better integration and accurate direction of scientific and technical work was emphasized, as it will contribute to the improvement of energy conversion processes.

Properties of Sinters and Pellets

On 4 December 1980, an international symposium took place at the Academy of Mining and Metallurgy in Krakow. It was devoted to physical and structural properties of sinters and pellets. Over 50 scientists from Poland, France, Sweden and USSR participated.

The symposium was organized for the 70th birthday and 45 years of work of Professor Eugeniusz Mazanek as a professional metallurgist and 30 years of his scientific work as an outstanding Polish specialist in the field of sintering and blast-furnace technology. Professor Eugeniusz Mazanek received the title of meritorious teacher of the Polish People's Republic.

Symposium of Sport Medicine

On 23 and 24 October 1980, a Symposium of Sport Medicine took place in Jelenia Gora and Karpacz. Representatives of leading centers of sport medicine of Poland, Czechoslovakia and GDR participated in this symposium.

Nineteen reports concerning medical aspects of endurance training were discussed. Reports by Professor Stanislaw Kozlowski, director of the Institute of Work Physiology of the Polish Academy of Sciences, and Jan Mulak, a well-known trainer and sport activist opened the discussions.

On the occasion of this symposium the Provincial Ambulatory of Sport Medicine in Jelenia Gora started its operation.

Convention of Cardiologists

On 16 and 17 November 1980, the 36th Scientific Convention of the Polish Cardiological Society took place in Katowice. Nearly 800 heart specialists from all parts of Poland, from Hungary, GDR and Czechoslovakia took part in the meetings.

Nearly 250 reports were presented, concerning, among others, problems of heart arrhythmia, echo-cardiography, experimental cardiology and new diagnostic and therapeutic methods in the field of cardiology. Scientific films were also shown.

An exhibition of medication and of the most modern medical equipment serving cardiology were presented. Nearly 40 domestic and foreign firms presented their products.

15th Conference of Dental Surgery Section

On 16 and 17 November 1980, the 15th Scientific Conference on Dental and Reconstructional Surgery Section of the Polish Surgeons' Society took place in Lodz. Several leading specialists from academic centers of Poland and from a dozen or so foreign scientific centers took part in the conference.

One of the more significant subjects discussed during the conference was immunological problems in plastic surgery, important in tissue grafting. Moreover, surgical methods--cranium-facial-torso--were discussed comprehensively. Among the new ways presented, attention was drawn to the problem in plastic surgery of applying microscopic technique in tissue transferring.

This conference had substantial importance in enriching medical knowledge, particularly in relation to the increasingly popular demand for this kind of therapy, due to a growing number of accidents, mechanical and thermal injuries as well as congenital defects. Representatives of the Warsaw scientific-research center showed, how to overcome obstacles impeding transplants of other persons' tissues or transmission and anastomosis of sinews, skin, nose, bones, cartilage and even nervous systems. Representatives of the Lodz center presented their rich experience in surgical treatment of congenital defects in small children.

Days of Dutch Technology

From 17 to 26 November 1980 a presentation of Dutch accomplishments in science, technology and economy took place in Warsaw. In this second Dutch show in Poland, representatives of more than 20 firms and research institutes presented to Polish specialists reports about agriculture and animal husbandry, horticulture, food industry, the building trades and telecommunications.

The Week of French Technology

From 24 to 30 November 1980, a Week of French Technology took place in Poland: namely, in Warsaw, Katowice and Gdansk. Experts from 30 French firms and industries specializing in various technologies presented more than 60 lectures, attended by nearly 4,000 Polish technicians and engineers.

The week was organized by the French Association of Mechanical Industry and Metal Processing (FIMTM) and by branches of the French Center of Scientific and Technical Documentation.

The formal inauguration of the week was attended by Pierre Aigrain, French secretary of state for scientific research, and Jacques Dupuy, French ambassador in Poland. The Polish Government was represented by Janusz Gorski, minister of education, higher and technical schools.

The week was sponsored by the French Center of Foreign Trade and the Polish Chamber of Foreign Trade (PIHZ). Its aim was the strengthening of contacts between Polish and French industrial and technical centers and of scientific and technical experience exchanges.

Exhibits of Scientific Publications

For the Days of the Soviet Book, traditionally held in Poland, exhibits of Soviet publications were organized in Warsaw and other cities.

On 10 November 1980 the exhibit of Soviet books opened in the House of Polish-Soviet Friendship in Warsaw. Nearly 900 titles of new books were shown, representing the following fields: sociopolitics, science and technology, belles-lettres, books for children and teenagers and books on sport. There also were numerous beautifully edited books of art: monographs, albums, art encylopedias, richly illustrated works dealing with separate periods of cultural history, schools of art and authors. Much space at the exhibit was devoted to Russian and Soviet classics and also to world classics, including Polish ones.

The Center for the Propagation of Scientific Publications of the Polish Academy of Sciences, the State Educational Publishing House and Ossolineum--the Publishing House of the Polish Academy of Sciences--as well as the Soviet Publishing House Education organized, from 10 to 15 November 1980, at the Palace of Culture and Science in Warsaw, an exhibit of Soviet scientific books. More than 600 titles of the newest publications were presented, including "Biorhythms and Work," "Acoustic and Optical Methods of Information Processing," and "Power Engineering of Photosynthesis in Plant Cells."

From 8 to 13 December 1980, an exhibit of U.S. universities' publications was organized at the Katowice Branch of the Scientific Publications Department of the Polish Academy of Sciences. Nearly 600 books were presented in the fields of humanities and social sciences, including archeology, philosophy, religion, art, history, sociology, politics, law and literature, as well as the field of exact sciences, including mathematics, geography, architecture, biology and medicine.

An appropriate catalogue, published for this occasion, helped visitors in selecting books.

New Scientific Periodical

A new scientific-technical periodical "Materials' Engineering," devoted to the interdisciplinary theoretical and practical branch of knowledge, was launched by the Presidium of the Main Council of the Chief Technical Organization (NOT), on

the initiative of NOT and of domestic centers developing this branch of technology. Professor Tadeusz Lamber became the chief editor of this bimonthly publication.

According to the foreword from the editors, this periodical has to "fulfill an integrating function relative to separate materials' groups as well as branches of technology. It appears to be necessary in view of unfavorable reaction of divisions and barriers between trades in the solution of materials' problems.

"'Materials' Engineering' intends to present results of applicable research concerning all kinds of materials, such as metallic, plastic and ceramic substances, as well as composites. It will be a multitrade periodical, serving vital interests of many aspects of the national economy. In the nature of its content and level of scientific description, this periodical will find readers among scientists, engineers and technicians who have to solve material and technological problems in design or production activity.

"The periodical also intends to inform about general world trends and achievements of this branch of knowledge.

"It also appears to be necessary to join a wider international forum than presently reached, with problems of materials' engineering, particularly within the realm of the Council for Mutual Economic Aid (RWPG)."

No 1 (September-October 1980) includes the following articles: Adam Gierek, Lech Bajka, Tadeusz Zajac--"Changes in Al-Si Alloys Caused by Their Intensive Mixing Within the Temperatures Liquidus-Solidus"; Stanislaw Mrowec--"Heat Resistance of Special Alloys on the Groundmass of Nickel"; Tadeusz Lamber, Jerzy Gierek, Eugeniusz Hadasik--"Analysis of Plastic Working Processes of Titanium Alloys on the Basis of Plastometric Research"; Andrzej Bylica--"Present State of Aviation Structural Materials"; Edmund Grochowski, Joanna Wozniczka--"Means of Obtaining and Methods of Increasing the Strength of Thin Metallic Wires"; Jan Cwajna, Marek Hetmanczyk, Adolf Maciejny, Jan Onderka--"Application of Methods of Quantitative Metallography for the Evaluation of Initial and Secondary Structure of High-Speed Steel." In addition, the publication includes information on conferences and consultations, on the activity of the Instructive and Educational Group of the Ministry of Education, Higher and Technical Schools-Materials' Engineering and announcements and instructions for the authors. Within the first pages of the periodical short resumes of articles are given in Polish, Russian and English.

The periodical's editorial office is located in Katowice, and the publisher--Publishing House of Technical Periodicals and Books SIGMA--NOT Enterprise--is in Warsaw.

From Scientific Publications

The work of a full member of the Polish Academy of Sciences, Waclaw Gajewski, and Professor Piotr Weglenski--"Genetic Engineering"--appeared in the series "Problems of Contemporary Biology" (Warsaw, 1980, State Scientific Publishing House, PWN, 260 pages, 1 table).

The book deals with problems connected with "genetic engineering"; i.e., with conscious manipulation of genes, chromosomes or their fragments, in order to obtain planned changes in genetic properties of organisms. The following problems have been presented: transformation and transduction of animal and plant cells; recombination and cloning of DNA, directed mutogenesis and cellular engineering. The authors presented also examples of these problems' applications in the cultivation of wheat and other grains.

Stanislaw Leszczycki, a full member of the Polish Academy of Sciences, is the author of a work titled "Facing the Map of Poland. A Geographical Economic and Plastic Study." It appeared in a series "Forecasts, Perspectives" (Warsaw, 1980, Book and Knowledge, 508 pages, illustrated).

The author presented a many-sided characteristic of the spatial structure of Poland's management and of its geographical, historical, political and economic conditioning with special consideration to the country's development after the Second World War. These considerations pertain also to changes forecasted for the future to the year 2000.

[No 5-6, May-Jun 81 pp 183-193]

[Excerpt] II

Agreements on Scientific Cooperation of the Polish Academy of Sciences (PAN)

On 28 October 1980 in West Berlin an "Agreement on Scientific Cooperation Between the Historical Commission in West Berlin and the History Institute of the Polish Academy of Sciences" was signed by Cz. Madajczyk, full member of the Polish Academy of Sciences and director of the History Institute PAN, and Professor Dr M. Biskup--for Poland--and Professor Dr O. Busch, chairman of the Historical Commission in West Berlin and Professor Dr K. Zernack--for West Berlin. The agreement concerns the promotion of historical studies and, in particular, archival research concerning Polish-German relations. It also specifies organizational and financial conditions of scientists' exchange. The agreement became effective immediately.

On 13 May 1980 in Warsaw, W. Markiewicz, full PAN member and secretary of the First Department of Social Sciences PAN and Professor F. Furet, president of the Ecole des Hautes Etudes en Sciences Sociales (EHESS) (School of Higher Studies in Social Sciences), signed a document extending the "Agreement Between the First Department PAN and EHESS for the years 1981 to 1983." The agreement provided, among others, for the organization in Warsaw of a colloquium on the subject "Transmission of Cultural Models," the initiation of cooperation in the field of contemporary history and inclusion in the exchange and cooperation programs of the following subjects: preserving patrimony; workers' culture in the 19th and 20th centuries; history of culture and cultural models in the preindustrial period; changeability and continuity in communal life; large and small domain; social and demographic history of the family. Cooperation in the fields of sociology, economy, archeology and material culture is also anticipated.

On 7 November 1980, in Warsaw, the full PAN member and president of PAN, Witold Nowacki, and Gunnar Hoppe, member of the Royal Swedish Academy of Sciences and its president, signed a "Protocol on Cooperation Between the Polish Academy of Sciences and the Royal Swedish Academy of Sciences" for 1 July 1980 to

30 June 1983. During the debates it was ascertained that the cooperation of both academies was particularly efficient in studies of the following subjects: electronic properties of metals; biologically active polysaccharides and glycon-jugates; central nervous system; functional and classic analysis and algebra including the number's theory; energy and human habitat; physics and chemistry of condensed bodies. This cooperation contributed substantially to the realization of the Final Act of the Conference on Security and Cooperation in Europe.

During the debates it was agreed that PAN and the Royal Swedish Academy of Sciences will, from 1980 to 1983, include 23 subjects; concerned agencies will coordinate working plans in which the following problems will be defined: aim, forms of cooperation, commitments, responsibility and other conditions of co-operation.

Limits of bilateral clearings and financial and organizational conditions of co-operation have also been coordinated. In 1982, PAN will organize the third Polish-Swedish symposium on the subject of mechanics of micropolar centers. The Royal Swedish Academy of Sciences will organize in January 1981 a round-table discussion on the subject "Food Production--Maintenance--Health," with the participation of science academies and scientific institutions of the five Nordic countries and eight socialist countries of Central and Eastern Europe.

From 1978 to 1980, the cooperation between PAN and the Royal Swedish Academy of Sciences included 15 subjects. The Institute of Physical Chemistry PAN and the Physics Institute of the Goteborg Polytechnical Institute are conducting measurements of electric conductivity of silver iodide with high mobility of cations in a wide pressure and temperature range. Results have been presented in 1978 at the Conference of Solid Electrolytes in Scotland and in 1979 at the U.S. Conference of Highly Conductive Solid Salts. The Biochemistry and Biophysics Institute PAN cooperates on the subject of biologically active polysaccharides and glycon-jugates. Results have been presented in two publications; two later ones, concerning polyprenol metabolism in tissues cultivated in vitro, and also the NMR analysis of polyprenoidal compounds obtained from new sources, are in preparation. The Institute of Experimental Immunology and Therapy PAN is conducting joint studies on the same subject. Among others, research was carried out on the antigens O Shigella flexneri and Shigella sonnei of phase 1, with the application of gaseous chromatography technique, mass spectography and magnetic nuclear resonance. Structures of O-specific oligosaccharidal units have been established for these two Shigella groups. Results were presented in two publications. The Center of Experimental and Clinical Medicine PAN, in conjunction with the Swedish partner, published in the "Acta Physiologiae Scandinavica" results from the field of respiration physiology. A work from the field of limestone metabolism regulation in glioma cells and of centric processing of respiratory information, transmitted by the vagus from the lungs, has been prepared for publication.

On the subject of functional and classic analysis and algebra with the theory of numbers, the members of the Mathematical Institute PAN have proved the nonexistence of weak-zero bases in the L^1-space and developed a new method of calculating norms of operators 2--absolute summing--so a small number of vectors be taken into consideration. The Institute of Biocybernetics and Biomedical Engineering PAN carried out joint studies in the field of computer processing and biomedical

pattern recognition as well as biomedical languages programming for pattern information processing.

On 26 November 1980 in Helsinki, T. Orlowski, full PAN member and first deputy of the Scientific Secretary of PAN, and Professor K.O. Donner, president of the Academy of Finland, signed a "Protocol of Scientific Cooperation Between the Polish Academy of Sciences and the Academy of Finland for the Years 1981 to 1983." During the debates it was established that the cooperation of academies was successful, resulting in several important effects, and that it contributed substantially to the realization of the Final Act of the Conference on Security and Cooperation in Europe. Both delegations commented with satisfaction on the organization of the Polish-Finnish symposium on the subject of system analysis and its applications in industrial and economic problems, which took place in Poland in November 1980.

PAN and the Academy of Finland will cooperate in 23 subjects from 1981 to 1983. Both academies will select the persons charged with individual subjects and the interested groups will coordinate work plans, which will determine the following: the aims of cooperation, its forms, commitments, responsible parties and also cooperation conditions. Stipulations of personal exchanges, trip financing and organizational conditions of cooperation have also been established. The protocol is binding from 1 January 1981 to 31 December 1983.

During 1979 and 1980, PAN and the Academy of Finland have realized jointly 22 subjects. On the subject of environmental ecology, the Ecology Institute PAN in cooperation with the Finnish partners conducts explorations concerning the utilization of parasitoids and their role in the limitation of great numbers of field heteropters in agrocenoses. Studies are also done of the invertebrate fauna in natural and cultivated meadows and of energy and matter flow in mineral meadows and peatbogs. Results of joint studies of the Zoology Institute PAN with the Finnish partners on ants as an indicator of urbanization pressure have been presented in a joint publication, dealing with the genetic affinity of ants from the Fornica species. The Oceanology Institution PAN cooperated with scientific units of Finland within the framework of the international Baltic monitoring program and included the intercalibration of biological methods.

In the area of genetics, the Human Genetics Institute PAN published four works on the domain of lymphocytes I in reaction to graft rejection and of surface studies of lymphocytes and antigens I receptors, cultivated by genes of immunological response. In the area of clinical, physiological and basic neurological studies, the Center of Experimental and Clinical Medicine PAN in cooperation with the Finnish partners carried out studies of nervous system structures, taking into special consideration the conductive apparatus. Knowledge has been acquired in histochemical techniques of ultrastructural studies, permitting a differential evaluation of a series of neuromediatory systems and ultrastructural studies of the hypothalamo-hypophyseal system. The Center of Experimental and Clinical Medicine PAN cooperates also on trends of mutagenic and canoerogenic mechanisms' action of industrial chemical substances. Results of studies on bonds of carbon tetrachloride with nucleonic acids of rat's liver and brain have been published. The Biocybernetics and Biomedical Engineering Institute PAN cooperates in medical bioengineering in the area of biomagnetic fields studies

with the application of superconductive detectors SQUID and of a reader for the blind, as well as with speech synthesis area related to this reader. Scientists of the Animal Genetics and Husbandry Institute PAN and Animal Physiology and Feeding Institute PAN familiarized themselves with research studies at the Finnish scientific centers and exchanged information on physiological and feeding stuffs (straw, silage) and improvement in the efficiency of animal and milk production.

The cooperation of the Institute of Low Temperatures and of Structural Studies PAN dealt predominantly with the application of the Josephson phenomena in the measurements' technique. The Physics Institute PAN cooperated in studying possibilities for using SXS and XPS for imitating the streaked structure of materials used in electronics. A publication on X-ray spectroscopy and photoelectron methods in studying transitional metals' alloys is being prepared. On the subject of geophysics, seismology and physics of the ionosphere, the Institute of Geophysics PAN in cooperation with its Finnish partners published, among others, a joint work by R. Tesseyre and R. Vesanen, "Symmetry and Asymmetry in Geodynamics"; a work by B. Gadomska, "Mechanisms of Earthquakes--a Survey of Methods," has been prepared for publication; a work by A. Kijko and S. Pirkonen, "Precision of Calculating Epicenters and Time in the Earthquakes' Focus in the Fennoscandia Region." Preliminary works are under way to carry out joint studies of deep structures, using methods of explosive seismology on a 300-kilometer profile in Central Finland. The Center of Cosmic Studies PAN in cooperation with the Oulu University carried out measurements of integrated electron concentration in the ionosphere.

In 1978 Polish sociologists, together with their Finnish partners, published a book in the domain of macrosocial analysis of social transformations in Poland and Finland--"styles of life." On the subject of labor laws, the Institute of the State and Law PAN concentrates on the following problems: deviation and studies connected with alcoholism, labor laws, international laws with particular regard to Finnish transit across Poland and legal aspects of international economic cooperation.

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On 5 December 1980 in Warsaw, Jerzy Kolodziejczyk, corresponding member and deputy scientific secretary of PAN, and Istvan Lang, corresponding member and deputy secretary general of the Hungarian Academy of Sciences (WAN), signed the "Protocol on Scientific Cooperation Between the Polish Academy of Sciences and the Hungarian Academy of Sciences for the Years 1981-1985." In the debates, an evaluation of results obtained during the 1976-1980 cooperation period was made, and it was ascertained that the realization of the problem-subject plan was impressive. With this evaluation, as well as requirements and possibilities of both academies, this cooperation was extended by applying principles of scientific cooperation in selected subjects, using optimal forms of cooperation, etc. During the period 1981-1985, PAN and WAN will work on 28 subjects, 10 in cooperation. Scientific centers of both academies will coordinate and sign work plans before 15 May 1981, defining aims, tasks and anticipated results, as well as possibilities of their application, duties, performers, time-limits, forms of work termination, forms of cooperation, etc. Independently from the established

subject matter, PAN and WAN will cooperate on problems pertaining to planning, utilizing results of scientific research, training and perfecting scientific personnel, financing, effectiveness of international scientific cooperation, legal and organizational problems, etc. Recognizing that experts' reports and forecasts allow efficient exploitation of accumulated knowledge, it was decided to undertake cooperation in this area in the form of experts' reports and forecasts' exchange, sharing or joining in their elaboration. During the years 1981-1985 there will be cooperation with patents and licenses. Possibilities and the need for cooperation in developing scientific instrumentation and automation of scientific research have been assured as well. Limits of bilateral clearings have been established, and financial as well as organizational cooperation conditions approved in the following fields: terms of creating joint study teams, of employing at regular posts and also undertaking works to simplify organizational functions connected with this cooperation.

During the years 1976-1980 PAN and WAN have worked out 17 problems within the framework of bilateral cooperation. This cooperation has various forms, among them joint studies, consultations, organization of bilateral conferences, seminars, etc. In the area of perfecting and developing legal systems in the Polish Peoples' Republic (PRL) and Hungarian Peoples' Republic (WRL), the Institute of State and Law of PAN conducts with its Hungarian partner regular exchanges of legislative and scientific information, publishes on the basis of reciprocity three to five scientific treatises in its own publications and organizes sessions; for example, in 1980 a session devoted to family law. The Mixed Historical Polish-Hungarian Commission is operating actively. In 1976 in Budapest this commission organized a Polish-Hungarian colloquium devoted to the history of Poland and Hungary against the background of the division of Europe into the Eastern and Western parts during the Middle Ages and during the modern times. In 1979 Polish historians participated in a conference organized in Hungary, "Antimilitarism in Poland and Hungary in the 16th Century," and Hungarian historians took part in the conference on "Socinianism in the European Culture in the 17th to 18th Centuries."

The Agrophysics Institution PAN participates in studies of water flow in the soil and of physiochemical phenomena connected with it. Four joint conferences on physical soil properties and agricultural materials have been organized. Moreover, a unique scientific equipment for the study of soil mechanics is being utilized.

The Physics Institute PAN and the Institute of Low Temperatures and Structural Studies PAN cooperate on problems of physical bases and new materials for electronics. Among others, kinetics of epitaxial GAAS layers, obtained from the fluid phase was studied, as well as crystallization microprocesses during electroepitaxy. Polish scientists presented part of the results from the Visegrad Symposium on Optical Crystals' Physics in 1980. The Polish Institute of Basic Problems of Technique PAN (IPPT) and the Laboratory of Acoustic Studies WAN developed and carried out an experimental verification of methods and systems of measurement, numeral processing, analysis and synthesis of acoustic signals with a particular regard to the speech signal for the acoustic diagnosis of biological (organ of speech) and technical (machines, technological processes) of sound sources and of bilateral communication "man-machine" in the natural

language, with the help of speech signal. In the theoretical bases of resistance and optimization of machine and building structures, IPPT PAN worked out, among others, a comparison of a theoretical solution of resistance and energy absortiveness of compressed thin-wall elements with the results of static and dynamic pillar crushing. The Institute of Molecular Physics PAN, in cooperation with the Central Physics Institute WAN, obtained a particularly valuable result; i.e., they discovered and investigated the result of phase transition in the salt NMc4, 2 Me Py $(TCNQ)_2$, using electrical methods. A joint publication has been prepared as well: J. Galica, L. Nemes--"Study of Self-Extension of the Rotational Pressure Transition $11_{1,10} - 11_{1,11}$ in the H_2CCO Molecul[illegible]"

The Institute of Geography and of Spatial Farm Implementation PAN cooperates with the Institute of Geography WAN in the field of farm implementation of rural areas as a multifunctional space and of changes occurring in these areas. Results of this collaboration were presented at the third seminar organized by the Hungarian partner in 1978, and by the Poles at the fourth seminar in 1980. Materials from these seminars have been published by both institutes. The institutes also carry out studies in agriculture typology. From 1979 to 1980, the Polish group prepared a synthesis "On the Applicability of Quantitative Methods in the Spatial Analysis of Agriculture." In the direct cooperation of both agencies the following organizations take part: Department 5 of Agriculture and Forestry Studies PAN, which cooperates with the Ministry of Agriculture and Food Supply of the Hungarian Peoples' Republic; United Institutions of Scientific Instrumentation Production PAN with the KUTESZ Industry; and the Center for the Propagation of Scientific Publications PAN with the Publication WAN Akademiai Kiado.

Social Politics and Socialist Democracy

On 20 and 21 January 1981, an all-Polish Conference on Social Politics and Socialist Democracy was organized in Warsaw by the Regional Committee of the National Unity Front (FJN), the Polish Economic Society and the College of Social Sciences (WSNS) of the Central Committee of the Polish United Workers Party (PZPR). The aim of this conference was a discussion of the basic trends of social policy under the new socioeconomic conditions and preparation of conclusions to be addressed to the Ninth Commission of the Extraordinary Convention of the Polish United Workers Party (PZPR).

Three reports have been presented: Sylwester Zawadzki, corresponding member of PAN--introductory report; Dr Przemyslaw Wojcik, assistant professor--"Foundations of Socialist Social Policy--Realities and Needs"; and Dr Leon Brodowski--"Regional Social Policy During the Period of Economic Unbalance." Social workers and politicians, scientific workers, theoreticians and practicians, representing various academic centers and research institutes, representatives of Solidarity and of trade and autonomous unions, management members of economic institutions and administration organs and people of various outlooks on life participated in the discussions.

The conference was an occasion for the exchange of experiences and opinions, a valuable form of participation of people engaged in the formation of social politics in this nationwide debate before the Ninth Extraordinary Convention of PZPR. The keynote of almost all statements was the conclusion that attempts to disturb the links between social politics and the development of socialistic democracy always lead to tensions and crises with dangerous consequences.

International Ship Symposium

From 11 to 13 February 1981, an international symposium devoted to research and design problems of ship propellers was organized in Gdansk by the Ship Propellers' Works of the Institute of Flow Machines PAN, the Ship Institute of the Gdansk Polytechnical University and the Center of Ship Technology.

Representatives of 13 countries participated in the discussions--namely, Bulgaria, Holland, Japan, GDR, the United States and USSR, as well as 42 Polish specialists.

The symposium program included 18 reports, 5 presented by Polish specialists. The last day of the symposium was devoted to a visit of the Hydrodynamic Research Center in Gdansk-Oliwa.

The Gdansk symposium was preceded by a conference of the International Propeller Committee (IPC) in Sopot on 9 and 10 February 1981. Professor Henryk Jarzyna, manager of the Ship Propeller Works IMP PAN in Gdansk, is a member of IPC since 1975, representing the Center of Ship Technology. During the 3-year tenure (1978-1981), the IPC prepared a report on the state of knowledge in the field of ship propellers and formulated research tasks for the years to come.

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Problems of Agricultural Production

On 5 February 1981 the Section of Economics and Organization of Agricultural Production PAN organized in Warsaw the annual symposium, the subject of which was problems connected with agricultural production.

Two reports were presented at this meeting: "The Past and the Future of Specialization of Individual Farms in Poland," presented by Professor Z. Wojtaszek, and "Effects of Costs on the Course and Level of Agricultural Production in Poland," presented by MS L. Staszynski. Problems of the formation of agricultural autonomy and of securing means of production for agriculture were discussed. The need for a constant study of agricultural production unit costs was emphasized, as well as increasing the deliveries of means of production for agricultural production development particularly the chemical means, in the nearest future.

Attention was drawn to the fact that agriculture will be able to feed the state population in a stable and sound partnership only with the industry. An economic reform of industry and agriculture should ensure a long-lasting partnership of both these branches of economy.

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Biotechnology in Food Production

On 11 and 12 February 1981, the Institute of Agricultural Chemistry and Technology of the Agricultural Academy in Lublin and the Committee of Food Technology and Chemistry PAN organized in Lublin a scientific session on the

subject "Biotechnology in Food Production." Nearly 250 specialists from the agricultural academies, trade institutes and polytechnical institutes across Poland, who deal with food matters, participated in the discussions.

Over 200 reports and communications were presented and discussed in five problem sections: albumin biosynthesis, enzymes, microbiology, fermentation technique and dairy work. The communications concerned such problems as albumin biosynthesis on the basis of nonconventional coal and energy sources; optimization of production conditions of yeasts' biomass, bacteria and lower fungi; enzymes' biosynthesis; optimization of conditions in the use of enzymatic specimens in the food production; technology improvement in the production of beer; evaluation of milk and albumen specimens from milk; selected problems of fish and krill processing, a method of marking certain food components.

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From Scientific Publications

The Economic Society prepared a volume entitled "Problems of Planning and Socioeconomic Policy" (Warsaw 1980, PWE, 584 pages). This work was intended to commemorate the scientific literary output of Kazimierz Secomski, full PAN member.

This volume represents a collection of studies prepared by Polish and Professor Kazimierz Secomski. It consists of four parts: 1. "Problems of Socioeconomic Development"; 2. "Planning and Economic Policy in Socialism"; 3. "Problems of Shaping the Socioeconomic Expanse"; 4. "Science and Scientists." An extensive bibliography of Professor Secomski's works concludes the volume.

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Information on the International Congress on Ecology

From 5 to 11 September 1982, the Third International Congress on Ecology (INTECOL 82) will take place in Poland under the auspices of the International Ecological Society (INTECOL), Ecology Section of the International Association of Biological Sciences (IUBS) and of PAN. The Ecology Committee PAN and the Ecology Institute PAN are the organizers of the congress, which will convene under the motto "Ecology as the Basis of Habitat Management for the Common Well-being."

The conference will have six plenary sections (A-F) connected with detailed subsections (A1-E6), all taking place at the same time. Moreover, the organization of several technical meetings and symposia is foreseen (G). Their structure is as follows:

--A. Processes integrating ecosystems and landscape: A1. energy flow as factor integrating the environment; A2. mechanisms of matter transfer, exchange and accmulation in environmental systems; A3. biocoenotic and populational interdependences between ecosystems; A4. ecology of contact, barrier and ecotone zones; A5. problems connected with studies of multisystem units; A6. methods of studying ecological superecosystematic structures (among others, modeling methods).

--B. Progress in knowledge on the interaction between organisms in ecological systems: B1. role of parasites in ecological systems; B2. ecology and ethology --a synthetic approach; B3. plant demography; B4. relations--beast of prey and victim; B5. strategy and tactics of species biology; B6. evolutionary ecology and genetics.

--C. Reconstruction and stabilization of environmental quality: C1. theory and practice of recultivation methods in application to water systems; C2. ecological problems of landscape reconstruction; C3. program of ecological control (monitoring), of environment quality and of its components; C4. protected environments and biosphere reservations; C5. ecological effects of species extinction; C6. strategy of ecological systems' stabilization.

--D. Ecological bases of biological production intensification: D1. effect of changes in the environment and productivity and stability management of agricultural and forestry configurations; D2. effect of pest control on the production and quality of the environment; D3. environmental effects of crop rotation, breeding animals selection and landscaping planning, ecological directives for agriculture and agricultural-forestry landscaping planning; D4. ecological significance of traditional versus progressive agriculture; D5. influence of agricultural activity on the energy flow and matter circulation in the temperate and tropical region configuration; D6. influence of aquacultures on the ecology of water configurations (sessions D1. to D5. also concern pastures).

--E. Technological influence of man on the environment: E1. transportation, circulation and accumulation of toxic substances and pollution in the environment; E2. effect of pollution on various ecosystems; structure and performance; E3. bioindication of pollution on the level of the organism and of ecosystem; E4. salination of soils and waters; E5. radioactive contamination of the environment; E6. processes and strategy of deformed ecosystems.

--F. Ecology place and role in regional planning and otherwise; utilization of ecological expert appraisals in resources management and in spatial planning.

--G. Symposia and working consultations: G1. statistical ecology; G2. physiological ecology (on the subject of transferring laboratory data to regional studies and vice versa); G3. ecology of built-up areas; G4. environmental training; G5. water ecology (on the subject of wet soils); G6. seed-eating birds; G7. special symposium on the subject of ecology of polar regions.

Each section will be organized by Polish and foreign conveners, appointed by the Committee of the Third Congress of Ecology (INTECOL). The Polish conveners are coordinators of programs in a given section. Plenary sessions will include two to three problem reports presented by invited speakers who will be selected by the conveners and a discussion connected with these problems. The principal forms of active participation in the congress will be 15-minute oral reports, selected by the subsection chairmen; presentation of materials in the form of posters and scientific films; and also participation in working groups and symposia. English will be the official congress language.

The registration fee has been established at $100 for participants and $60 for accompanying persons and for students (upon presentation of confirmation from the college). The equivalent in Polish currency will amount to 3,000 zlotys for members and 1,800 zlotys for students. Polish members will pay a reduced registration fee of 1,500 zlotys, since Poland is the organizer of this congress.

Tourist and scientific excursions are an integral part of the congress (payable separately). There will be one midcongress excursion, included in the registration fee.

The first notification about the congress with the card for preliminary application will be mailed during the first half of 1981.

All correspondence and questions about additional information should be addressed to the Secretary's Office of the Third Ecology Congress PAN, Dziekanow Lesny, 05-150 Lomianki; telex 817378 IE PAN PL.

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CSO: 2602/2

CRITICISM OF SCIENTIFIC FIELD CONTINUES

Warsaw TRYBUNA LUDU in Polish 8 Dec 81 p 3

[Article by Tomasz Miecik: "Science and Reform: What's Behind That Curtain?"]

[Text] The criticism of science is not diminishing. It is no longer a question of last year's complaints: that now there are no great scientific schools, that science, especially the social sciences have become courtly, that the leadership apparatus has been permitted to treat science in an instrumental fashion. The questions which are now being asked at various meetings and are being addressed to TRYBUNA LUDU are more severe: What do we need so many scientific employees for? Why so many institutes? What are they doing there?

A few numbers would seem useful to start with. Well, in our country we have 84 centers of the Polish Academy of Sciences employing about 13,000 employees. There are 1,318 centers under the ministries (or equivalent institutions) employing about 218,000 employees, and then 88 institutions of higher education (excluding the Catholic University of Lublin [KUL], two theological academies, and the schools subordinate to the Ministry of National Defense and the Ministry of Internal Affairs) employing about 130,000 people.

Out of this total employment we can sort out the scientific research personnel. There are about 65,000 such employees, 65 percent of whom are employed by the institutions of higher education, about 25 percent by the ministries' and sectors' scientific research facilities, about 1.5 percent by the ministries' and sectors' various development facilities, and about 6.5 percent by the centers of PAN, the Polish Academy of Sciences.

Here is the immediate conclusion from this minidocumentation: In Poland, compared to other countries, including the socialist countries, there is a relatively small base of research and development facilities in the economy, that is, a relatively small link where all research achievements are translated into the language of technology, a relatively small bridge which decides the quantity, sort, and rate of the research results which are passed on for practical use. But even the level of employment of the scientific research personnel there is absolutely disturbing.

This is an extremely important sign of the pathology in the structure of the scientific-technical base, but it is not the only one. Let us take a broader look.

It seems that to understand the current picture of our science and technology we have to recall earlier years. Polish science started after World War II with decimated
was during the reconstruction period following the destruction of the war, in a period of unprecedented social changes, industrialization, and migration which committed tremendous resources of social energy and materials. Here, as Prof Jozef Smigielski correctly notes in NAUKA POLSKA, "The war, which in some countries was the most powerful stimulus for the development of science, in Poland was not only a factor which interfered with that development but was also a cause of its regression."

Under these conditions it became necessary to make up for shortages and lost ground and to construct from the bottom up a new organizational structure adapted to current and future needs. One can hardly be astonished that many omissions and errors were bound to occur in such an operation, which to a great extent took place through improvisation and spontaneity. Most of them can be ascribed to the extensive nature of the development of the sphere of science and technology.

The results of these errors are noticeable to the present day, because never in the past have they been corrected in any broad sense, and there were at least three chances to do it.

As everyone knows, the organizational model of the national economy first of all determines the condition and structure of the national scientific research and development base. Unfortunately, this model actually always favored extensive processes in research facilities.

It is true that we tried to find our own place in the international division of labor, to establish Polish specialties, but without any great success. In effect we took up the production of everything a little bit, and every area of manufacturing, every sector, had to have its own research facilities. Hence, they grew in number but not in quality. There was great dispersion.

Thus the organizational model of the economy deepened and expanded these unfavorable processes, instead of discouraging and correcting the extensive development of research facilities.

The strong facilities capable of effectively guiding technical and technological progress can provide for only a few or a dozen and some production sectors in a country the size of Poland. Instead of such concentration, we have for example in the vehicles industry the production of bicycles, motorbicycles, motorcycles, four types of automobiles, two types of delivery vans, trucks, two types of buses, two types of tractors, electric locomotives, railroad freight and passenger cars, agricultural air-

craft, parts for passenger aircraft, gliders, helicopters, passenger ships, passenger ferries, and so on, as Zbigniew Landau mentioned in "Economic History of the Polish People's Republic," published in KULTURA, in it 15 November issue this year.

Good international cooperation in this area could prove to be extremely helpful to our technical research facilities. In last year's resolution of the Polish Academy of Sciences, the institution responsible for the overal development of science in Poland, we read the following: "The current level of the socialized economy's employment of scientific personnel, which accounts for 5.7 percent of total employment, shows that further growth in the number of these employees can no longer be as intensive as the increase in the problems to be resolved." This statement was intended to help intensify cooperation with foreign countries as a means for expanding the capacity of the country's scientific base. As I recall, there has always been talk about the need to develop such cooperation, and the results of these efforts have been negligible.

One might fear that Poland could fail to be an attractive enough partner for such cooperation, given the tremendously dispersed research facilities, because everyone knows that in such international cooperation the countries with the clearest production specialization with science and technology focused around it are the most important. In what way could we fit into the principles of complementarity which are required in international cooperation, since we have such a large number of weak research establishments? I have in front of me a list of the centers in the Polish scientific-technical network. To read it is really shocking, because there are so many small centers which employ a dozen and some people but not a single scientific researcher.

In a country the size of Poland it is not possible to develop all the directions of research. That is obvious. The annual reports of PAN or a ministry clearly show how many new themes are being expanded through broad foreign cooperation. Somehow I never managed to find the figures about how many subjects our scholars could pass by and not take up because of effective international cooperation in science and technology.

During the past decade one more attempt was made to put the economy's scientific-technical facilities in order, to focus the potential on the most important research programs for the country and control them centrally. Unfortunately, we cannot say that this project was met with complete success either.

As the years went by, the number of priority research programs increased, and actually all research activity, important and completely worthless, began to fit into them. What is worse, even for the few absolutely most important research problems, called government problems, it was not possible to guarantee appropriate investments intended to facilitate the practical utilization of research results. Given the exceptionally extended research, the large number of centers involved in working on it, and the mess in coordination, any sort of control over the execu-

tion of the research became fiction. Many times attempts were made to put some discipline into these research efforts, and they all failed. Hence, this attempt to focus research potential failed to produce the expected results also.

In the resolutions of the Ninth Extraordinary Congress of the PZPR all these shortcomings of the scientific-technical facilities were examined, and a great deal of attention was devoted to linking science and technology to the economy, to bringing some order to international cooperation, and to focusing research efforts on a small number of research projects considered to be really the most important. The review of the scientific-technical facilities in the ministries is in progress. Many facilities have already been eliminated or combined into larger stronger organizations. The number of central research programs has also been reduced.

Will these measures bring adequate order to the matters of the scientific-technical facilities? Are they preparing this area to meet the economic reform? I am afraid that raising the curtain along with the start of the economic reform will reveal the scientific scene with a lot of defects. But its examiner will be very demanding. Life itself will monitor it. And then the answers to the questions posed at the beginning of this article will become apparent.

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JPRS 79819

8 January 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 727

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EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

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[Article by Eng Ivan Peceny, Kancelarske Stroje [Office Machines] special concern: "Making SMEP Minicomputers Available to Czechoslovak Users"]

[Text] As in the case of the classical "large" general-purpose computers (i.e. the JSEP [Unified Series of Electronic Computers]), the research, production and applications efforts of the CEMA countries in the minicomputer field have also been integrated by the Intergovernmental Commission on Data-Processing Equipment. In 1976, the SMEP (System of Small Electronic Computers) program, managed by the SMEP Council of Chief Designers (RHK), was created. RHK SMEP has several groups of specialists and temporary working groups to deal with specific problems involving the development, design, production and supplying of SMEP minicomputers.

The SMEP system is a combination of hardware and software systems, a system of standard-setting, procedural and operational guidelines, and a system of standards. In addition, this combination is supported by a reasonable degree of compatibility and standardization of the system, architecture and design approaches. The SMEP is intended for the creation of control-computer systems, which are used principally in systems for controlling manufacturing processes and units, systems for automating scientific research, automated design systems, and control systems for nonindustrial areas, as well as for commercial and engineering calculations which do not require large capacity. The SMEP is based on the cooperation and common effort of Bulgaria, Hungary, East Germany, Cuba, Poland, Romania, the Soviet Union and Czechoslovakia.

The principal areas of application of the SMEP include:

--automated control systems (ASR) for both constantly-operating continuous and constantly-operating discrete manufacturing processes and production units;

--ASR's for manufacturing procedures and systems for running control of noncontinuous production processes;

--systems for automating scientific experiments.

The SMEP project consists of two sequential stages, SMEP I and SMEP II. Currently, the beginning of series production and delivery is culminating the integration efforts of the SMEP I stage.

SMEP I includes the following groups of equipment:

--a basic series of four processors with different degrees of productivity (SM-1P, SM-2P, SM-3P and SM-4P);

--several types of external storage units, used to record data on magnetic tape or disks;

--an extensive selection of input-output units, including printers of various capacities, keyboards and punched-tape and card-processing equipment;

--displays, including alphanumeric and graphic types;

--units for interfacing with the environment or with the controlled process;

--equipment for telecommunications and intracomputer and intercomputer communications.

The SMEP system is designed as a uniform modular system making it possible to create control-computer systems with a variety of hardware configurations and to replace system components with others performing similar functions without changing the overall system function.

The SMEP software is based on the modular principle. This makes it possible to generate programs which provide the required operating modes and intended system functions in specific hardware configurations. SMEP software includes operating systems for various purposes, libraries, sets of system-oriented or problem-oriented applications programs, and sets of auxiliary, test and diagnostic programs.

The SMEP is designed as an open system. This implies the possibility of adding to and expanding both software and hardware. There are various ways of expanding the system:

--introducing newly developed general-purpose or special peripherals;

--introducing a wide variety of data-processing methods into SMEP software so as to expand the range of system applications.

The SMEP series is to be expanded both within the SMEP I stage and by the creation of SMEP II hardware and software.

Among the SMEP I computers we distinguish two branches, which differ from each other in their instruction sets, processors, method of connection of peripherals, interrupt organization and the like. The main differences between the processors thus are in the areas which determine the so-called "architecture" of the control-computer system, an aspect which depends on the particular processor.

One of the branches includes the SM-1 and SM-3 minicomputers, which are modeled after the Hewlett-Packard HP-21 minicomputer. Computers in this group are compatible with the Soviet M-6000 and M-7000 computers, which are also supplied to Czechoslovakia.

Fig. 1.

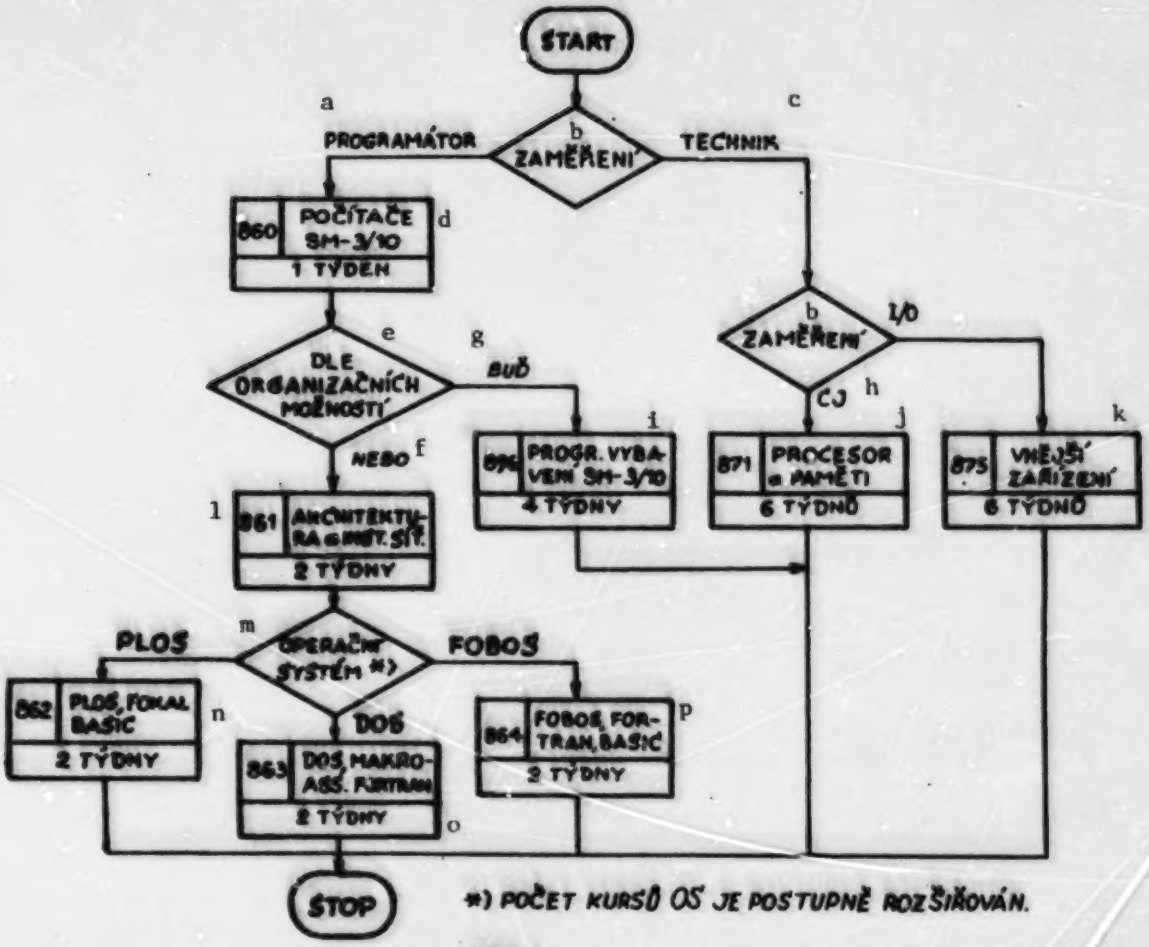

Fig. 1

Key:

a. Programmer
b. Orientation
c. Technician
d. SM-3/10 computer; 1 week
e. According to organizational capabilities
f. or
g. either
h. Mainframe
i. SM-3/10 software; 4 weeks
j. Processor and memory; 6 weeks
k. Peripherals; 6 weeks
l. Architecture and ; 2 weeks
m. Operating system*
n. 2 weeks
o. 2 weeks
p. 2 weeks

* The number of operating system alternatives is gradually being expanded.

The other branch includes the SM-2 and SM-4 minicomputers, whose model was the Digital Equipment PDP-11. The computers in this group are compatible with the Soviet M-400 computers.

Each group has one processor of lower power (SM-1P and SM-3P) and one of greater power (SM-2P, SM-4P). Processors within the same group have upward compatibility, i.e. the larger processor has all of the functional capabilities and architectural features of the smaller, while it also has additional capabilities and architectural features.

As regards the method of connecting individual devices into a computer system, the computers in the two groups differ in that:

--the SM-1 and SM-2 systems use the interface designated 2K;

--the SM-3P and SM-4P processors are connected to their peripherals by a common universal bus.

The mechanical components in both branches are standardized (e.g. in terms of the dimensions of boards, cable shelves and housings), and they have common peripherals (but different controllers) and the like. The different instruction codes used in the two branches result in two incompatible sets of software. After comparing the applications capabilities of the two series, all CEMA countries taking part in the SMEP project agreed to concentrate on developing the SM-3 and SM-4 group. This development (including software) is internationally coordinated.

Czechoslovakia is also focusing its development and production work on this series, while planning to meet its requirements for the SM-1 and SM-2 systems by import from the Soviet Union.

An overview of SMEP hardware which the individual participating countries have agreed to design as part of the joint project is given in the document "List of SMEP I Hardware." In this list, the hardware is divided into seven groups. The first group includes processors and internal memories; the second, external storage (mechanical devices and control units); the third, input-output equipment; the fourth, equipment for operator interaction with the computer (terminals); the fifth, data transmission equipment; the sixth, data preparation equipment; and the seventh, equipment for interfacing the computer with the environment.

In terms of research and development, the SMEP I stage may be considered to be essentially complete; currently the equipment is in series production.

Equipment in all seven groups on the list have been put into production in Czechoslovakia. Many SMEP hardware devices are being designed, planned for production and produced in Czechoslovakia to meet the needs of the Czechoslovak national economy. The frequently postponed beginning of series production of SMEP I computers in the SVT [?Data-Processing Equipment Plant] national enterprise in Banska Bystrice has been compensated by successive deliveries of SM-3 and SM-4 computers from the Soviet Union. Individual deliveries of the SM-1 and SM-2 systems from the Soviet union will not be considered here.

1. Import of SM-3 and SM-4 Computers from the Soviet Union

Deliveries of the SM-3/10 equipment (produced by Elektronmash, Kiev, USSR), which differs completely from the SM-1 system in terms of commercial technology (particularly as regards the prospects for Czechoslovak production of this equipment) consist of a set of hardware items and the necessary software.

In 1978, TESLA provided a set of 45 SM-3/10 systems to Czechoslovak users in the base configuration, which consists of:

--the SM-3P processor (SM-2103);

--a 32-Kbyte internal memory (SM-3101);

--an external storage unit based on the IZOT 1370 disk mechanism (SM-5400);

--a matrix printer using the DZM-180 mechanism (SM-6302);

--an alphanumeric display based on the VIDEOTON VT-340 (SM-7205);

--the SPTP-3 punched-tape I/O unit (SM-6202).

This basic configuration is considered to be a single unit, including operating technical documentation, software and the media on which it is recorded, a set of spare parts, accessories and an installation kit.

The first deliveries of the SM-3/10 were made to selected enterprises of the then TESLA VHJ, both for testing and for creation of software by the organization, which, as part of multilateral international cooperation among the CEMA countries, creates the basic and applications software and performs further research, development and production work within the SMEP system, as well as working with special applications of SMEP computers outside the scope of this international program.

Other deliveries made in 1979-1980 by Kancelarske Stroje national enterprise and Datasystem went to organizations which had brought their plans for incorporating data-processing equipment into agreement with worldwide trends sufficiently in advance, and whose organizational structure and other critical factors would allow them to make full use of the so-called "distributed intelligence" information system. The critical factor in the successful conclusion of commercial and technical discussions dealing with the purchase of SMEP systems is whether or not the individual organization contemplates introducing SMEP equipment in integrated fashion for a whole ministry, VHJ or enterprise. The extent of integration of the equipment to be introduced is also a critical factor in realizing the advantages of modular structure which SMEP equipment potentially offers. The modularity of the SMEP equipment makes it possible to introduce the so-called base configurations, which then will be gradually added to. The selection of equipment for expansion includes equipment from the base configuration (use of two or more displays and the like), magnetic tape storage, floppy disk storage, and display stations for local or remote connection.

As part of this country's import from the Soviet Union, in 1979-1980 an additional 44 of the SM-3/10 systems were delivered in the agreed-upon configuration, which had been established through studies of the interests of the Czechoslovak users and the applications in which they were to be put to use, and in accordance with the development and production capabilities of the Soviet supplier and the other suppliers of SMEP equipment within CEMA. Most of these systems were equipped with external storage subsystems using the IZOT 5003 magnetic tape store (SM-5301).

In 1980, KSNP [Kancelarske Stroje national enterprise] and DSNP [Datasystem national enterprise] began to supply imported Soviet SM-4/10 computers (produced by Elektronmash, Kiev, USSR), initially in a configuration identical with that of the SM-3/10 (two sets) and later in configurations including new types of peripherals (six sets delivered in 1980, another six in 1981).

The new types of peripherals are:

--the SM-6305 high-speed printer;

--the PK-1 casette-type magnetic tape store (SM-5208);

--the SM-5603 floppy disk store.

2. Deliberies of Domestically-Produced SM-3 and SM-4 Computers

After production got under way in 1980, the supplier organization ZAVT [Automation and Data-Processing Equipment Research and Development Base] undertook distribution of the SM-3/]0 computer (produced by ZVT Banska Bystrice) in the following base configuration:

--the SM-2301 processor;

--a 16-Kbyte (8-bit) semiconductor main memory (SM-3510);

--the DARO 1156 printer (SM-6301);

--the SM-7202 display unit;

--the SPTP3 punched-tape reader and punch (SM-6204);

--the IZOT 1370 disk-pack unit (SM-5400).

KSNP delivered 30 of the SM-3/20 computers to customers prepared for their installation, while DSNP delivered 60.

3. Basic Software Delivered with the SM-3 and SM-4 Computers

The basic software consists of a range of operating systems intended to allow the use of SM-3 and SM-4 computers in all expected fields. Thus the individual operating systems are to a certain extent applications-oriented, which means that they allow the computer system to operate effectively in a certain applications area or areas.

This orientation of the operating system (i.e., abandonment of the general-purpose operating system concept and orientation toward a specific applications area) is necessary for small computers primarily because of their small capacities (compared with larger computers). On the other hand, the specific orientation of an operating system brings benefits stemming from the most effective use of the computer system.

As in the case of the hardware of the SM-3 and SM-4 computers, the basic software is produced as part of the international cooperation between the CEMA countries. Czechoslovakia also takes part in this cooperation. A practical consequence is that specific operating systems are supplied with the computer, while others can be obtained from the national program library. A survey of the most important operating systems and their characteristics is given below.

The software of the SM-3 and SM-4 computers includes the following types of operating systems:

a. Punched-tape operating systems

--a general-purpose punched-type operating system (PLOS/SMEP), including interactive punched-tape program system (DS/SMEP, FOKAL);

--a real time punched-tape operating system (PLOS-RV).

b. Disk operating systems

--a general-purpose disk operating system (DOS/SMEP);

--a real-time disk operating system (DOS-RV) with a fixed number of priority levels, intended for controlling scientific experiments and data collection and analysis;

--a basic real-time operating system (FOBOS/SMEP);

--a real-time operating system with variable task priority and an extensive set of system functions (OS-RV);

--a dialog disk operating system (DIAMS) for collective access, intended for information-related tasks and creation of data banks;

--a disk operating system with time sharing (DOS-RVR).

The categorization of operating systems in terms of their storage media and orientation can be shown in the following table:

System orientation	System medium	
	Punched tape	Disk storage
General purpose operating system	PLOS/SMEP (DS/SMEP, FOKAL)	DOS-SMEP
Real-time operating systems	PLOS-RV	DOS-RV (and MOS-RV) FOBOS/SMEP OS-RV (and BOS-RV)
Operating systems with time sharing		DIAMS DOS-RVR

The variety of applications of the SM-3 and SM-4 is due in large part to the variety of operating system. There are operating systems which create a multiprogramming environment and operating systems intended for a single user.

The DIAMS and DOS-RVR operating systems are intended for multiuser applications. The first operates with the MUMPS language, is disk-oriented, and allows interactive parallel access to a computer by up to 40 users. The DOS-RVR uses the Macroassembler language, BASIC-Plus, FORTRAN IV-Plus and COBOL. Up to 69 jobs can be processed simultaneously, including the creation and execution of programs.

OS-RV and DOS-RV are also multiuser operating systems; they are intended primarily for applications with dynamic characteristics. Greater flexibility is achieved in the DOS-RV operating system at the cost of increased response time. The DOS-RV operating system can be modified during system generation. Both systems allow interactive and batch processing. The (B)OS-RV operates with Macroassembler, FORTRAN IV and COBOL, while the DOS-RV operates with Macroassembler and FORTRAN IV. Both of these systems allocate the processor in response to a specific event, and allocation is not generally based on a fixed-time interval.

The multiprogramming operating systems include the MOS-RV, which organizes the execution of programs generated under the DOS-RV operating system (it will be discussed in more detail below).

The LOS, DOS and FOBOS operating systems are intended for the single user. The LOS operates with Assembler, BASIC and FOKAL, DOS with Assembler and FORTRAN, and FOBOS with Macroassembler, BASIC, FOKAL and FORTRAN.

Automatic programming systems can be categorized as follows in terms of their purposes:

--the Assembler, Macroassembler, ROKAL and FORTRAN IV-Plus languages, combined with a suitable operating system, are the primary ones used in the control field. Basic, FORTRAN IV and the expanded version FORTRAN IV-Plus mentioned above are most suitable for scientific and technical computations. Besides the standard form of BASIC there is an expanded form called BASIC-Plus.

The main characteristics of these expanded forms as are as follows:

--in FORTRAN IV-Plus, arithmetical expressions may be field subscripts, and a field may have up to seven subscripts; the set of input-output commands is expanded, and bytewise and bitwise operation is possible through logical operations with numerical values;

--BASIC-Plus has commands for manipulating sets of data, allows the formulation of complex conditions, and provides functions for matrix algebra (matrix inversion, addition, multiplication and the like).

Table 1. Survey of SM-3 and SM-4 Operating Systems

PŘEHLED OPERAČNÍCH SYSTÉMŮ SM-3 A SM-4 Tabulka 1

Operační systémy 1	Systémový nositel 2	Nárok na OP 3 min.	Nárok na OP 3 max.	Programovací jazyky 4	Programový režim 5	Sdílení času 6	Dávkové zpracování 7	Určen pro uživatele 8	Ochrana souborů 9
PLOS/SMEP (soubor samostatných programů) 10	děrná páska 11	8K	28K	Assembler Basic	jedno- 12 programový	ne 13	ne 13	1	ne 13
DS/SMEP	děrná páska 11	4K	28K	Fokal &	jedno- 12 programový	ne 13	ne 13	1	ne 13
PLOS-RV	děrná 11 páska	8K	28K	Assembler	jedno- 12 programový	ne 13	ne 13	n	ne 13
DOS/SMEP	kazetový disk 14	16K	28K	Assembler Makroassembler Fortran IV	jedno- 12 programový	ne 13	ano 13	n	ano 15 (ident. kód)
FOBOS/SMEP	kazetový disk 16 pružný disk	16K	28K	Assembler Makroassembler Fortran IV Basic & Fokal & VU-Basic &	jedno- 17 programový nebo dvou- programový	ne 13	ano 18	1	ne 13
DOS-RV (MOS-RV)	kazetový 14 disk	12K	28K	Assembler Makroassembler x Fortran IV-RV x		ne 13	ne 13	n	ano 18
OS-RV (BOS-RV) *	kazetový 14 disk	16K	124K	Assembler Makroassembler Fortran IV Cobol +	multi- 19 programový (až 250 sou'.ážných úloh)		ne 13	n	ano 15 (ident. kód)
DIAMS	kazetový 14 disk	16K	124K	MUMPS &	multi- 20 programový	ano 18	ne 13	n	ano 18
DOS-RVR	kazetový 14 disk	32K	124K	Assembler BASIC-Plus & Fortran IV Cobol	multi- 21 programový (až 69 soubežných úloh)	ano 18	ne 13	n	ano 18

Key: 1. Operating System
2. Medium
3. Internal memory required
4. Programming languages
5. Programming mode
6. Time-sharing?
7. Batch processing?
8. Number of users
9. File protection?
10. Set of independent programs
11. Punched tape
12. Single-program
13. No
14. Disk pack
15. Yes (identical code)
16. Disk pack, floppy disk
17. Single-program or two-program
18. Yes
19. Multiprogram (up to 250 jobs simultaneously)
20. Multiprogram
21. Multiprogram (up to 69 simultaneous jobs)

COBOL (standardized form) is intended for economic applications. MUMPS, which was standardized in 1976, is intended for use with data banks (creation of files, updating, retrieval), but also for description of arithmetical and logical operations. In its latest forms, it is a representative simple language for data banks.

The effective introduction of the SM-3 and SM-4 minicomputers is also supported by auxiliary programs, which are used primarily for preparation and editing of source texts, generation of working programs, and the listing of jobs or data.

The main characteristics of the SM-3 and SM-4 operation are shown in Table 1. The components of the SM-3 and SM-4 software include sets of application programs which expand the capabilities of the operating system regarding the use of mathematical methods of data processing and the collection, transmission and teleprocessing of information.

The operating systems shown in Table 1 which are or eventually will be available to Czechoslovak users will include the operating systems delivered with computers, those released by Czechoslovak design organizations for user testing, and those distributed by the supplier organization (for example, the Kancelarske stroje special concern is preparing to offer in 1981 a choice of operating systems, to be generated in the required configuration, including documentation and consulting services, on the basis of separate economic contracts). The table below also provides data on some so-called "higher" operating systems which are under preparation and are expected to become available.

Table 2. Survey of deliveries of SMEP operating systems

operační systém [a]	dodaný jako součást výpočetního systému [b]				mimo dodávku počítače [c]	
	SM-3/10	SM-4/10	SM-3/20	SM-4/20	řešitelem [d] k ověření	organizací [e] NOTO za úhradu
(P) LOS	1978 3.	1980 3.	1980			1981
DOS a DOS/RV	1978	1980				
FOBOS-1		1981 x	1980 2.		1979	1981
OS–RV *		1980 x				
(R) DOS-RV 2 § *			1981 1 x	1981		1981
DIAMS				1981 x	1980–1	1982
DOS–RVR		1981 x			1981	1982
FOBOS–2					1982	1982–3

1. tzv. nemapovaná verze
2. VU Basic a OS-VÝUKA za zvl. úhradu zákazníka
3. včetně PLOS-RV

x v rámci volitelného programového vybavení za zvláštní úhradu zákazníkem

§ v rámci volitelného programového vybavení za zvláštní úhradu lze rozšířit o Fortran IV-Plus a Basic-Plus-2

Key:

a. Operating system
b. Delivered as part of computer system
c. Separate from delivery of computer
d. Delivered by designers for testing
e. Delivered by NOTO for fee **
1. So-called "unmapped version"
2. VU BASIC and OS-VYUCKA special payment by purchaser
3. Including PLOS-RV
x. As optional software, special payment by purchaser
§§ As optional software, FORTRAN IV-Plus and BASIC Plus-2 may be added for special payment

8480
CSO: 2402/1

STATUS OF HUNGARIAN RESEARCH IN COMPUTER TECHNOLOGY

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 81 pp 4, 5, 11

[Unsigned report: "Parallel Information Processing, Cell Automats, Parallel Processors, Multiprocessors; The Status of Domestic Research, III"]

[Text] In the eighth part of our series we gave space to a debate connected with domestic research and the results achieved. The debate was led by Ivan Szabo, our colleague and the editor of the series or rather the organizer of the conversation. We feel that we served a good purpose by providing a forum for the meeting, permitting the participants and those interested to get to know one another better and thus making possible productive and lasting communication and work contacts in the future.

We were happy that the initiative of our editors was evaluated positively by several participants in their contributions and by others after the end of the program. The basic question is still open: What might be done or what might be worth doing in the interest of making use of our achievements in this area? The comments confirming or detracting from the several opinions or trends are the best indication of what differences in thinking exist. We hope that in the future the opinions of those interested will confirm rather than detract from one another. (The Editors)

Fay: I think everyone would be interested in what Tamas Legendi would expect from VLSI if it could be achieved in Hungary. What size cell space would be needed for a 64 K byte sorting algorithm if there were 10,000 gates in one module?

Legendi: VLSI represents a problem but also special possibilities. In my opinion manufacture of it will not begin in Hungary in a short time.

VLSI represents a very great possibility. Its use increases by orders of magnitude the quantity of parts which can be placed in a unit area. Parallel computers could not be built before because their size would have been greater than the size which could be built. So the parallel computers already developed in theory could be considered realistically only by increasing integration. With the switch from MSI to LSI, it became possible to build parallel machines, at least in the laboratory or in small series. With another increase in element capacity within a module (VLSI) the entire system capacity can increase and we can work with a larger number of

processors, perhaps with different types of processors. VSLI brings up typical, new problems. The design considerations within one module are different, the problems of system compatibility are different, integration increases more quickly than the number of pins.

It is characteristic of many tasks, however, that the task as a whole or the higher level parts of it have less broad input-output requirements than the lower level parts of it.

As for the other part of the question, if we suppose an integration level of 10,000 gates per module then a 64 K byte sorting field would need a cell space consisting of about 1,000 modules. Let me add that within a foreseeable time period VLSI technologies will make possible a gate/module ratio greater than this by 1.5-2 orders of magnitude.

Domolki: Let me try to compare the three activities reported on, not primarily to evaluate them, but rather from the viewpoint of their relationship to what was said in Mihaly Sandory's introduction.

In all three cases there are processor elements which can be called cells, which are linked together according to some more or less fixed geometrical arrangement. They work together according to the so-called cell automat principles, thus "they communicate with their neighbors." But here one can see a very essential difference which determines much. Namely that the size of these elementary processors in the solution of the Legendi type is very small, they are "microcells" of 20-100 gates. According to Doman's idea they are much bigger, the size of a smaller microprocessor, essentially carrying out one operation. For Fay they are even larger, virtually microcomputers which can independently carry out an entire program. If we examine these conceptions only from the viewpoint of parallelism (which solution makes best use of the possibilities deriving from parallelism, which is least afflicted by limitations arising from neighboring contact), then we can say that the smaller the elementary cell, the "more parallel" its operation, that is, the more elementary circuits or gate parts which can be activated at one time; the less operation is disrupted by the fact that the information which must be transmitted from the environment is available only with certain constraints. But the larger the elementary cell, the larger the part that must operate in the traditional way (for example, the individual "more elementary" circuits within a microprocessor are obviously not organized in parallel). What is more questionable here is now much time is needed, at the price of what hardware expenditure, to acquire the small amount of information which must be acquired for so much computing activity; thus, is it worthwhile to load it into such a neighborhood pillory?

This is one side of the problem, already taken up by Sandory, and if we think now of the type of problem posed by Sandory, then what is involved is an examination from the second viewpoint of the paths mentioned by him, namely, how can speed be increased with the aid of parallelism.

The other question raised by Sandory was how to devise an architecture which can best reflect the structure of the tasks to be solved (on the one hand, from the viewpoint of having the operations and data with which we work distort as little as possible, via conversion or coding, that world which we want to model and, on the other hand,

that the connections and parallel structure of these should reflect as much as possible the parallelism naturally present in the task). In this connection I feel that the dataflow principle used and further developed by Doman is that with the aid of which we can best approach the solution of the problem from the side of architecture. But I would like to make two observations; one is that for the time being we are talking only about an approximation, we are still very far from a solution. I feel that the most essential problems of this solution are posed by the programming theory, computer science, artificial intelligence aspects of it and only after these are clarified can we really raise the question of what architecture is best suited for it. My other observation is that I think those practical compromises which exist in Doman's present model tend to take us away from this trend and bring us closer to the traditional cell trend.

If we look at Fay's thinking purely from the viewpoint of parallelism and strip off those other considerations (social, psychological and computer science theoretical) which have been mentioned here, then we find parallelism primarily in a form which means taking the machine apart every day and putting it together every evening. For part of the life of each computer, it can work entirely in parallel with others, but put them together and they work as one machine. From this viewpoint it makes no difference (when the Fay type boxes are linked together in the evening) whether they are linked as cells, or in the traditional way, or however.

Szabo: Thank you, Balint Domolki, for your summary evaluation. I think this provides a good basis for debate. So I ask for comments.

Legendi: In the case of traditional computers, efficiency is a problem which has been swept under the rug. It is customary to say, since we have had operating systems, that utilization of computers is 90-95-100 percent. This is an oblique way of saying that the large functional units--the CPU, the I/O processor--are being used to a significant degree. At the level of bit-sized storage elements or gate-level circuit elements, the utilization of traditional computers is only 10 to the minus 6 or 10 to the minus 7.

This was one of the motives for cell-processor research and I think that we wanted not only to gain speed but efficiency also, indeed primarily that. If we were to achieve a realizable system one of the limiting constraints was that we had to work with microcells. Finally, however, a much more efficient architecture came into being which made it possible to get efficiency greater by three or four orders of magnitude, that is, greater performance for the number of parts specifically used. I say that this could be done only with a microcell organization, and this coincides with the qualitative observation of Balint Domolki that progress toward the microcell gives a level of greater parallelism, and makes possible really parallel, bit parallel programming.

In connection with task structure, I feel that what was said by Sandory is rather far from what we are talking about today. There are intelligent task-specific languages and program-synthesis methods. We are dealing with architectures and are three or four levels removed from this problem. It may be that we are providing a better basis for such matters because, in a certain sense, contemporary architecture (as Tibor Vamos has said in one of his talks) is, for example, an obstacle to working out really new languages. One possible reason why new languages cannot really break through is that just any language cannot be run efficiently on this architecture. But I would like to add that at the microlevel it is precisely our

microcells which make possible an adaptation to the structure of the task in the sense that one can develop completely optional operation executing units basically via software, by loading, connecting them in the cell fields. So we load operation executing units of just the size and in just the number necessary for the task.

Vamos: I have two observations. First, I believe the world has gotten beyond the philosophizing level of saying how nice it would be to be able to operate in parallel. Today we can take a task oriented approach to the architecture question since in many respects general problem-solving ability boils down to parts complexity, and we must assemble something useful out of these parts. It is obvious that every basic type of task demands a rather special architecture. We see this in all those special machines which we are trying to produce, even at the domestic level, whether they be graphic systems, machine-tool control, or picture- or sound-processing equipment. The task is similar for a data-processing system or even a communication system. So I am sympathetic to the formulation of Tamas Legendi. He can recommend relatively optimal solutions at the given technological level for a special task. I think that this is what is essential, and not the general slogan that now, "should we process in parallel or not," because there are tasks where the parallel solution makes no sense and there are others that perhaps could not be solved differently under the real conditions. Sound processing, for example. We know that we must reach a speed domain of at least 1-10 gigaflops to be able to process continual human speech with a vocabulary of, let us say, 1,000 words.

The other thing I would like to clarify is the purpose of our conversation and our role in it. We are talking at very different levels of information on three quite different themes. On the basis of what I know and on the basis of my impressions, what the Szeged group is doing is the most mature.

At one time I started, inspired by Kalmar, with 10 years of very hard, very many published achievements and failures, building on one another. And there were very hard debates in professional circles, differences in view as a result of which there is now a more settled approach.

I do not know the work of Andras Doman in much detail, but what he said and what I now quickly understand (perhaps quite poorly) fits in nicely with that international thinking in regard to dataflow solutions. This has a rather solid and well thought out mathematical and theoretical foundation which has been subjected to professional criticism. The whole thing is closer to the linguistic level and, for this reason and because of everything, its maturity level is farther along in a certain sense.

This is not a criticism, but a status statement, in comparison to where the Szeged group stands. Since this is a profound professional problem it is difficult to comment on the smallest details of it. But it is obvious that it is worthwhile to deal with this interesting trend.

The work of the third group is a little--at least to me--nebulous. I received a sort of prospectus 2 days ago and I could not tell if they were talking about a manufactured device or if it was a preliminary informational report. It said that one could get a book containing further details, but one feels a certain antipathy toward such things. In a word, I do not think this conception has been really thought out. About a decade ago, in connection with earlier theoretical work of Fay's group--which they published in various places--I recommended that it would be good to take it to an international scientific forum. In our small domestic

provincial circles it is much less possible to deal with a sphere of problems which is generally fashionable and which has been worked out over a very long time. But at the level of international scientific forums you have people who have been dealing with the problem for a long time, in a professional manner, with mathematical precision. Such critical intellectual work should be taken from the domestic arena to respected and competitive forums. It is there that we can learn the most and, on the basis of my own experience, I know that I not only sweat blood but had the most bitter experiences when I finally met readers who took a look at what we had done, pointed out its weaknesses, and frequently pointed out also that we had not paid enough attention to the work of some research groups. I say these things because the responsibility of research, of expressing opinions, must be taken very seriously and we must provide opportunities and an impulse to subject to criticism in a responsible manner those works which grow beyond normal practice. After this there suddenly appears equipment at who knows what stage of completion, with many unclarified questions. It may be that the developers are completely innocent in this, that the journalists for the daily papers made the mistake. But the question arises: What is this device in the final analysis? And an answer has not been given to this question today either.

Finally, as I have said, "very different things are on the tablecloth" here. We can contribute on the basis of very different information. So I would like to ask the respected leader of the debate: What is the purpose?

Szabo: The purpose, insofar as possible, is to pour clear water in the glass! A person wants to provide answers to unclarified questions, for the profession and for himself. If this forum can clarify questions by a certain approach, then we have provided something for professional public opinion and for ourselves. Insofar as the debate has hung up at a given level--that is how far we got.

There is also an apostolic aspect to our purpose. After we all see that different trends have met here, we should consider whether it is possible to bring them closer together--if there is some similarity in them--strengthen their harmonics and not scatter our resources.

And finally, we, the representatives of the journal, as providers of information, would like to inform and be informed.

Fay: To be informed. I am very happy to be here because I am being informed about what the others are doing and I am happy that we can exchange ideas. I have a quick, brief answer to one of the questions raised by Balint Domolki, to which Tamas Legendi also reacted. Namely, the structure of task solution. This is very exciting. Everyone tacitly takes it for granted that there is a structure to the solution of problems. The question is how to adapt to this, what architecture reflects this, and how special hardware corresponds to it. I believe that in the case of complex problems (for example, mathematical ones) we cannot really talk about the structure of task solution.

If something has never been formulated formally then it becomes a heuristic task, one must puzzle out how to solve it. (The same task can be solved in many ways, even in mathematics. One architecture may correspond to one solution and a different one to another.) In my opinion, PROLOG is a good language which can serve as a "logical enzyme" in the sense that it breaks down the task ever more simply--not in hardware but into logically manageable small units, and it tells us when something has been defined and when it has not. This is how one gets

the structure for task solution. This is why the cell automat is better (other machines are good for this too, because PROLOG is not implemented in cell automats), because it helps to disclose the solution structure for a task defined by a human being. So I say that we would be wise, for example, in the case of a verbally formulated task, if we tried to formulate, "extract" or "surgically remove" a certain structure for task solution.

Doman: I would like to add a thought to the question of Tibor Vamos about the purpose of our meeting. In my opinion, one purpose (in addition to the fact that the three themes reported on were the pretext for it) was to provide a forum for parallel computing systems, with which the whole world, including Hungary, is dealing, where those interested could exchange opinions. In this way, those interested, or who might be interested, could express their opinions about the justification for research in Hungary or about its future directions. So the purpose was to talk about the theme in a broader circle to see what might be done or what is worth doing. As I see it, in addition to hearing about these research results, we would like to discuss this more broadly--obviously many would be interested in the opinion of others.

David: In connection with the structure of problem solving I took something different from the words of Balint Domolki. If we knew the structure of problem solving, if we put it under severe constraints, it could be very harmful. If we look at a Neumann computer, all the possibilities we can realize with that computer can be seen quickly. The problem can be solved only with a program built up out of the operations of the machine. For this reason, the programming process proceeds as follows: There is a reality to be modeled and the process of programming breaks this down in a number of steps through a number of transformations into a computer program, into a model. In the first place, we use some mathematical formalism. In the second place, we extend this formalism to a certain collection of data, transformations interpreted on the data, and operations which we feel stand close to the program carried out by the computer. We call this the system plan. At the end of this process, the data have become computer data and the transformations have become machine operations--that is, the model becomes a program.

In the first place, this process is too long and, in the second place, it has a limiting factor in advance, namely, that we know what machine we are going to use. The third problem (which is also a problem of mathematics) is that in every step of the process we distort it, make compromises, so that we can run the program on the given machine. (Among other things, this also happens when we transform actions which are parallel in reality into a sequential model.) We must make this process, the process of programming, shorter, more independent of the machine and less distorted. In the ideal case, the real problem could be broken down directly into a computational medium so that the problem and the picture of it thus derived corresponded to one another.

Braun: If we look back on human culture, the world, which is parallel in many respects, is with great effort described by models, by rules worked out by many generations, which make possible the sequential solution of tasks. The difference, as compared to what has gone before, I see in the fact that now we have a tool which lacks these foundations. There is no well-known path in parallel processing,

because the ways of thinking and the tools used thus far were not developed in this direction. So not only must we now use the tool with understanding, we must also prepare a parallel interpretation of the task, which is simple if we provide a collection of cyclic runnings of our sequential algorithms, which can be made parallel, but which is not simple if what is involved is a complete reformulation of a complex task. The other big difference is that in the case of parallel computers not only does the execution of operations become parallel, so does the use of storage. Central storage ceases to exist, and just this is one of the limitations on its applicability. If one needs a large storage capacity outside of the storage within the parallel computers then the advantages can be exploited in only a limited way. There was talk about a sort machine (we heard some gigantic numbers). But this sorting capacity, if we look at it together with a magnetic disk, cannot be exploited, because the transmission speed of magnetic disks does not make this possible.

There are a few things about which I have some doubts or of which I am afraid. Both the algoritim and the uncovering of hardware faults become much more complicated and require special tools. It could cause problems that systems tested with sequential simulation will behave a little differently in reality because of their parallel character!

I feel that the need is tremendous in the field of applications. I might mention as an example a well-known technique, the finite element method. Even with their speed of millions of orders of magnitude the fast sequential processors take 10-100 hours to solve problems in nuclear technology or statics computations. The time for the solution of such tasks could be reduced to a fraction by parallel processors.

Domolki: First, in regard to the question of task-solution structure. I was talking about conforming to the structure of the task and by and large I agree with what Gabor David said about this.

But I would like to add a few things. A task (if it is a task taken from the real world) always has a natural structure. (An example which comes to mind is that this debate would have a natural structure if everybody would talk to everybody else and thus a number of parallel activities would take place simultaneously. We are forced into a certain restricted framework by the limited abilities or our "hardware" so that we can only talk one after another because for the time being the ability of the human brain and sense organs to follow several conversations at once is rather limited.) So what is always involved is that when we take a task from the real world it must always be distorted in some way because of various limitations. Every tool which we use to solve a task involves more or fewer such limitations. Gyula Fay mentioned the example of PROLOG. With the stipulation "what, but not how" it expands the possibilities, but at the same time it forces the problem into the fetters of an appropriately selected array of first-order logic. This is a much broader and harder restraint than that into which, let us say, the instruction system of an IBM 360 would force the solution of this task. And this, again, is much broader than would be problem solving on, let us say, a Turing machine. But these are "only" quantitative differences and the problem could be solved this way or that way. I see two types of things to be done here. One is, we must find tools with the aid of which we can best approach the natural structure of the tasks; and let me add, I make no

difference between hardware and software tools because after a certain level it makes no difference what sort of architecture supports the solution. Of course, not from the viewpoint of speed. And this is the second thing to be done, we must find technical solutions with the aid of which these tools can be used with the greatest efficiency, or with the least loss of efficiency. It is here that I see the difference between the two paths mentioned by Mihaly Sandory. What we should talk about here today is the second. The cell matters of the Legendi type can help link the two problem spheres primarily by providing great "emulation depth" so that by using a relatively efficient device, which can be manufactured well and programmed well, with more or less difficulty, we can realize with little loss of efficiency those higher order tools which the first trend will produce.

Legendi: I would like to speak to several themes which have been voiced. First in connection with problem solving. Some time ago we held a parallel roundtable under the leadership of Mihaly Sandory, who said then: "The task has no structure." I agree that a task, in itself, has no structure which can be attributed to it unambiguously; but with continuous decomposition in the course of task solution we usually attribute some structure to it and then it is essential with what sort of architecture this is done and we develop an architecture which will be especially suitable to service the several classes of tasks.

In connection with the comment by Peter Braun, I would like to note that although I myself am a parallelism believer it must not be forgotten that the world has both a parallel and a sequential structure and, in accordance with this, both sides must be expressed in our algorithms and computer architectures. In an article concerning the life and work of Janos Neumann, in the first volume of a work prepared for the Neumann congress, I tried to examine the problem from the viewpoint of sequentiality, and it is clear that in certain areas which can be well circumscribed the sequential machines will continue to be dominant (for structural reasons). In general the transformation of problems is parallel-sequential. The parallel-sequential approach is characteristic of problem solving in regard to human society, even in regard to work-organization methods; a typical example of this is the production-line manufacturing method in large industry. (An analog of which, to a certain extent, is pipe line and/or parallel processing.) So, looking at it from the other side, parallel processing did not appear without any antecedents and despite the sequential nature of speech and writing it would not be correct to say that the sequential mode is the only possible, correct and adequate mode for human thinking, problem solving and algorithms. We might hazard the statement that if the special boundary conditions of the task do not prescribe otherwise, then we must study the greatest parallelism which can be found in the task and must express this in our algorithms and in our architectures.

In connection with our sorting machine and also as an essential consequence of LSI and VLSI technologies, I would like to point out that since electronic background stores will soon force out the disks, in the near future it will be possible to use the sorting machine even though it is still too fast (it was made with an outmoded technology but it has a speed of 5 M records per second independent of record length), indeed it will be possible to use it ever more efficiently and, in general, we must get ready to design and build central units capable of processing a data flow of 100 M bytes to 10 G bytes. Cell processors represent one alternative for the creation of such machines.

In connection with the question of homogeneity, I believe it is obvious--not only for manufacturing technologists--how important homogeneity is from the viewpoint of preventing failures in the manufacture of equipment and parts, in design and diagnostics and in the course of operation. The microcell approach not only results in homogeneity within the chips, which shortens the designing phase for parts manufacture, but also ensures other advantages mentioned above. Concerning the value of simulation results, we can say that their applicability is restricted. We are carrying out functional simulation which ensures that if someone builds a cell field then it will be programmable, the cell programs tested on the simulator will be operational on it. Naturally this must be tested with other and special methods, for example, with highly detailed simulation or by building a hardware model, to see how such a machine must be built. Finally, going beyond simulation, there was mention of verification, which can provide a guarantee of the correctness of our cell programs--if not absolute--much more reliable than testing. Our verification system implemented in PROLOG, already partly operational, using a symbolic simulation method which can be applied only in a limited way on sequential programs ensures that the bit parallel microcell algorithms satisfy task solution written in a global specific language.

Gantner: I am afraid that you have again succeeded in finding a theme which seems to support the idea--greatly simplifying things and anticipating the question--that we have shining research results but shortsighted industry is not inclined to make use of them. Let us try to win industry over (perhaps in some democratic forum) or perhaps we should dictate to it somehow--and at one blow solve our problems connected with innovation, efficiency and recognition of our scientific achievements. This would be an oversimplified and dangerous position because it would distract attention from real (unfortunately much more complex) problems and demoralize your scientific, technical colleagues, perhaps artificially opposing them to each other instead of closing ranks.

Do not misunderstand me, I see a great future for parallel information processing (although I arbitrarily expand the concept a bit, not limiting in in space, including especially, for example, the parallel operation of units in local networks which have computing power).

We turn great attention to every scientific-technical achievement which could aid the carrying out of Videoton's developmental tasks in the years ahead, including those which may have only scientific interest for us but which increase the technical culture of our workers. (Obviously there are very many of these and we can use only some of them).

So the question is turned around for us, it is not that there is a scientific achievement and what can it be used for, rather we have a number of serious user needs and technical problems. Is there a domestic or foreign scientific achievement which might help solve these problems? And this is a very great difference! This may mean that we have shining research results and shining innovative enterprises, but the results and the needs never get together. From the national economic viewpoint (and, in the final analysis, from the institutional, enterprise viewpoint) there is input, we have good organizations, but the output, which can be measured in products, is minimal.

The theme of our roundtable talk today is an example. As I have said, I think we are talking about very interesting things which have a future. But for us the question now is (and obviously this follows from the unique perspective mentioned above) will the achievements born here help in the domestic "socialization" of computer technology, will they provide a solution to the problems of office mechanization, cheap and efficient processing, data management for small and medium enterprises--to mention only the most important domestic problems, and not in the order of their importance. If so, will they fit into the domestic structure and are they the most efficient for us? If not, then could they be interesting from another viewpoint, is it worthwhile to spend energy on their cultivation, and how much?

It has been shown in innumerable cases that the critical R and D personnel and expenditures (including getting something into production) cannot be guaranteed in our homeland for most themes, that in so-called following or preparatory research less energy, by an order of magnitude, would suffice.

Someone mentioned the atom bomb. Well, I think there is no need to prove that neither Jeno Wigner nor Leo Szilard nor anyone else could have made one in Hungary; it would have been in vain to demand it from researchers and industry.

I think that the discovery and exploitation of fundamentally new principles cannot be the most important task of Hungarian technical life today. One cannot overcome the 5-10 year lag which can be measured in productivity and technical level (if it can be measured at all) with an economy of this size (or with larger ones, as well-known examples show) with great leaps by concentrating on the tip of the iceberg.

We must pay attention to the tip of the iceberg, but we must turn much greater energy to the underwater part (the part that ultimately determines the potential of a country) which, perhaps, is invisible from the "bird's eye view of science." So the question is not, should we deal with this theme, but rather who should do so and with what energy (expenditure). And this is the decision that is hard to make, but which cannot be avoided. Research trends which cannot be used directly today may be very important (indeed, it is these that usually bring new results) and one must not expect immediate industrial products from them. I am convinced that this decision cannot be made on democratic foundations. It can be prepared this way, but those who guide research must decide (that is what they are getting paid for) and they must assume responsibility for the decision.

And we must measure over the longer run what achievements (not piles of paper and "never again seen" exhibit models) are born in each area (profession or organization). Then we must draw the appropriate conclusions and if necessary.... If "personalities" are important anywhere then I think they certainly are in the guidance of research.

Finally, even if from the industry side we do not see or hope for the immediate utility of cell automats, there can be a responsible decision that they should be cultivated by the people X with the expenditures Y, because over the long run the energy and knowledge thus used will bring greater profit than if we turned it to solving the most important operational economic problems of today. And this decision must be made not by industry and not by professional society but rather by research guidance, and later they must be responsible for it too.

The decision need not reflect the opinion of the majority. I recall that it was a Hungarian mathematician who proved that in general joint decisions made entirely democratically are not the optimal ones. But later we must reckon with the decisions of today.

To sum up I might say that research on the problem of cell automats is not the most important problem for Videoton today, but we have faith that there will be a professional decision which will be in harmony with the importance of the role played by this theme in the national economy later. And if it is true that Hungarian scientific life is 5-10 years ahead of industrial development then it may not be so difficult to decide.

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HUNGARIAN EXPERIENCE WITH SM-4 COMPUTER

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 81 p 7

[Article by Lajos Ivanyos: "Experiences With the SM-4 Computers"]

[Text] In the fall of last year, readers could learn in the columns of this journal that the Automatic Works of the Measuring Instruments Factory (MMG AM) was among the first domestic purchasers of the Soviet-made SM-4 computers. Last year, in honor of 7 November, Soviet installation experts but the first SM-4 configuration in operation at the MMG AM in a very short time (a total of 6 working days).

The time which has elapsed is sufficiently long for us to report on the first operational experiences to those interested in the development of the MSZR [minicomputer system] program. Since the MMG AM wants to use the machines of the MSZR series primarily for process-control tasks the first experiences were the subject of a recent lecture organized by the Electronic Computers and Control Equipment Section of the Measurement Technology and Automation Scientific Association (MATE).

At the request of the editors, I am publishing in written form an abridged version of what was said in my lecture.

The MMG Automatic Works, which has valuable traditions and experience in connection with development, design, manufacture, installation and operation of process instrumentation and process-control systems, has undertaken a significant role in the petroleum and natural gas supply program of the CEMA countries in the areas mentioned above.

The development of a modern product and systems structure required numerous experiments, transfer of licenses and know-how and acquisition of imported equipment. In the preceding plan period, significant support in this was provided by the KGM [Ministry of Metallurgy and the Machine Industry] and the OMFB [National Technical Development Committee] (program-controlled machines, computer-programming systems, a precision foundry, a computerized materials-testing laboratory, process-control program packages and developmental system, etc.). Among the obligations assumed in connect with this support was that the MMG AM had to study the questions of the applicability of minicomputers which could be obtained in the socialist relationship and, insofar as possible, adapt the process control program packages for them.

At present, the computer park of the MMG AM consists of two ES 1010's, one PDP 11/34, and PDP 11/04, two TPA 1140's and two SM-4's.

The PDP 11/34 computer, which was installed in the first half of 1979 in connection with the purchase of process-control and machine-tool-programming program oackages (and which serves the development of process-control systems, machine-tool-control programs and programs which can be used in other areas of the production activity of the enterprise), justified the broad applicability of members of the PDP 11 series with storage capacity greater than 32 K words and of minicomputers compatible with them. It became possible to do tests in connection with the fitting of cassette disks and matrix printers obtained from the socialist camp to the PDP 11 computer and, vice versa, the testing of the TPA 1140 put into operation during 1979-1980 and the SM-4 computer mentioned in the introduction with an original DEC operating system. Since the TPA 1140 and the Soviet-made SM-4 correspond to the PDP 11/40 and not to the PDP 11/34 which has a floating decimal processor, we generated RSX systems for testing at the compatible software level. Beginning in November 1980 an RSX system was also used on the SM-4 machine for the MMG AM's own developmental work; this is a fundamental condition for using program systems purchased under a license.

The tests showed software compatibility in regard to operating systems, program languages and applications-oriented program packages.

At the hardware level, compatibility between the PDP, TPA and SM machines was not provided at the module level due to the differing development of the system units and module connections. But bus-level compatibility makes possible an exchange of functional units between the various types with minimal transformational work. So the results of the compatibility tests are unambiguously positive in regard to the PDP 11, TPA 1140 and SM-4 machines.

The common characteristics of the SM-4 series computers, the Soviet one now tested and the Czechoslovak, Bulgarian, etc. versions which may come later, are:

--bus-level hardware compatibility;

--software compatibility, including the usability of RSX 11 operating systems;

--a broad supply of quality software;

--storage which can be expanded to 124 K words (248 k bytes);

--environmental (climate) operating conditions which are not strict; and

--cheapness.

The MMG AM is doing the following program development work on the SM-4 computers:

--process-control centers (delivering a telemechanical system to the Soviet Union in 1981, delivering a system to guide a gas-compressor station to the Soviet Union in 1982, etc.);

--technical and data-processing applications within the enterprise (FORTRAN, BASIC) and data preparation; and

--program development for the SM-4 and for mini and microcomputers using the INTEL 8085 processor.

Figure 1 shows a typical SM-4 configuration in process-control systems of the MMG AM. The hatched units do not figure in the Soviet delivery. In the first applications, these parts were supplemented by hardware-software adaptation of SAM 85 modules developed and manufactured by the MMG AM (peripheral expansion unit, semiconductor storage expansion unit). Finding sequential, asynchronous adaptation units missing from the Soviet deliveries is a key question for applications within the MMG AM (remote terminals, higher level computer links, process terminals, a quasigraphic display, etc.).

In addition to the solution mentioned (based on the SAM 85 modules manufactured in series), we have begun development of a more generally usable solution with which we can exploit the bus-level hardware compatibility of computers delivered by various manufacturers. We also developed a system unit made exclusively of parts which the MMG AM also uses for other purposes and so has always on hand. The sequential adaptation, etc. cards manufactured in the MMG AM can be plugged into this.

In this way, it becomes possible to supplement the missing units which are difficult to acquire or which can be acquired only at too high a price not only in the case of the SM-4 but also for our PDP 11 machine. Figure 2 shows the structure of our SM-4 configuration which has been in operation since the end of November 1980.

An independently operating small machine can also be assembled from the spare units of the two SM-4 systems ordered from the NOTO OSZV [NOTO National Computer Technology Enterprise]. The computer technology people of the MMG AM installed this basic configuration (16 K words of storage), put together and tested in Budapest, in the Kecskemet factory unit of the enterprise in March 1981, and they put it into operation without outside help.

Putting the second, larger SM-4 system into operation was completed on 1 June 1981, after about 1.5 months of work, by people from the Kiev factory. The extra work here was represented by the installation of three casette disk units, additional storage modules and three magnetic tape units (for example, the magnetic tape control unit and the cards in it arrived with a noticeable mechanical deformation).

After running factory tests, we tested the configuration with an RSX 11 operating system generated on our PDP 11/34. The signing of the delivery protocol took place on 3 June after 2 days of testing and the configuration was put into use.

We expect displays, floppy disk and storage units as further expansions for our SM-4 machines and in the future we ourselves will make the sequential adaptation units.

Finally, our experiences acquired with the configuration in operation since November:

Failures--

--there were shipping deformations;

--we found contact soldering problems on a number of circuit cards in the first months (such failures did not appear after repairing them);

--failures were caused by rigid cables breaking off from connectors of cables moved (if possible the drawers should not be moved in and out);

--connectors shook loose, especially cable connectors and the NYAK connectors securing the cables;

--disks hung up primarily because those putting the unit into operation sometimes forgot final tightening of the stop screws; and

--power-unit failures (the permeable transistor in the storage power unit and the rectifier bridge diode in the disk power unit).

(Note: In the more than 6 months prior to the day of the lecture we had to stop for the last two reasons in the list on an average of 8 hours of daily operation. Regular weekly maintenance eliminated the previously mentioned failures.)

Sensitivity--

--lasting network voltage drops resulted in unreliable operation (according to the specifications, the guaranteed range was 220 Volts plus 10 percent or minus 15 percent). Unfortunately we recently have often had network voltages under 187 Volts!

--the effect of quickly repeated brief network outages coincides with what was said above. According to our experience this is a frequent phenomenon between 1530 hours and 1800 hours at the MMG AM, No 41 Szepvolgyi ut, District III!

--heating of the cassette disk unit; about half an hour after switching on the cassette disks heat up significantly;

Disks written on when warm cannot be read without error in the "cold" state and disks written on when cold cannot be read without error in the "warm" state!

--environmental temperature; lasting operation at an environmental temperature above 30 degrees Celsius can cause unreliability in a number of essential circuit units and can cause lasting irregularities (power units and storage blocks).

Maintenance requirements--

--daily clearning of mechanical peripherals (reader, punch, DZM-180) and checking and adjustment weekly;

--checking cable connectors at least weekly;

Figure 1.

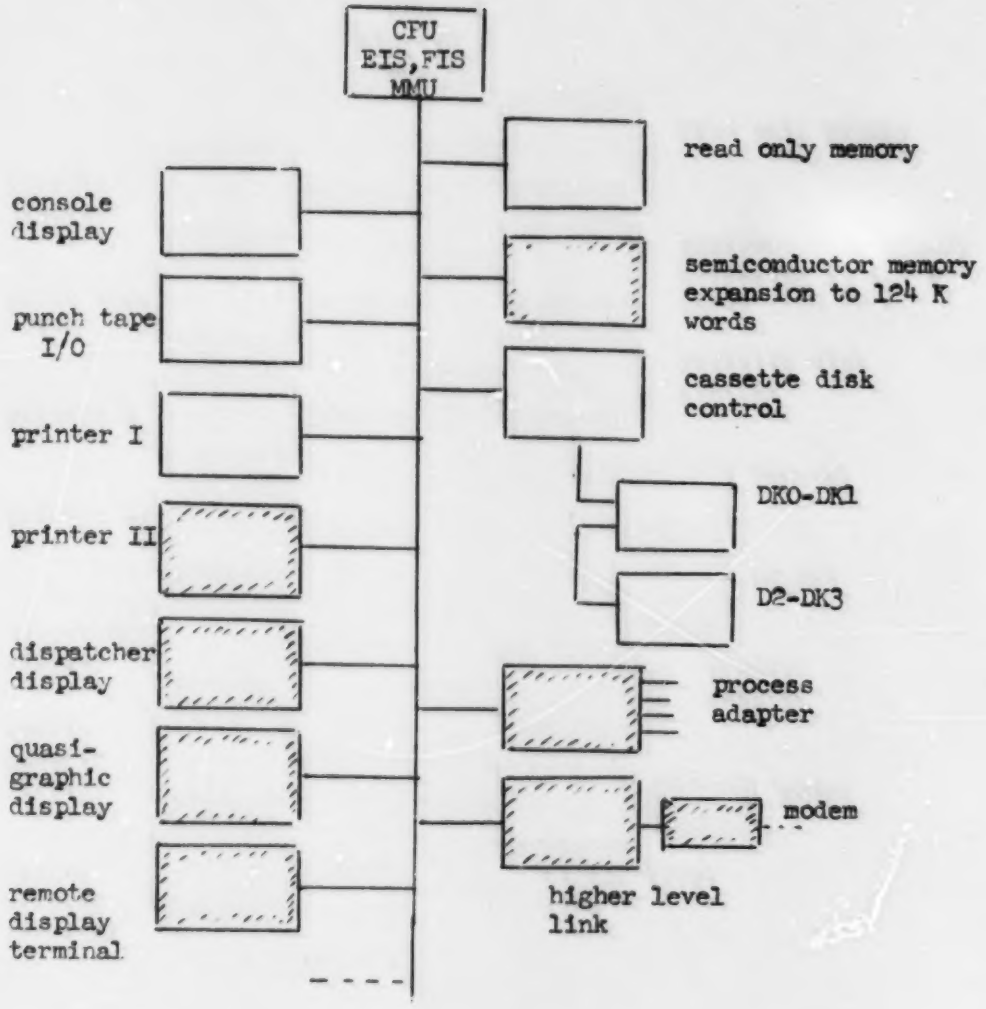
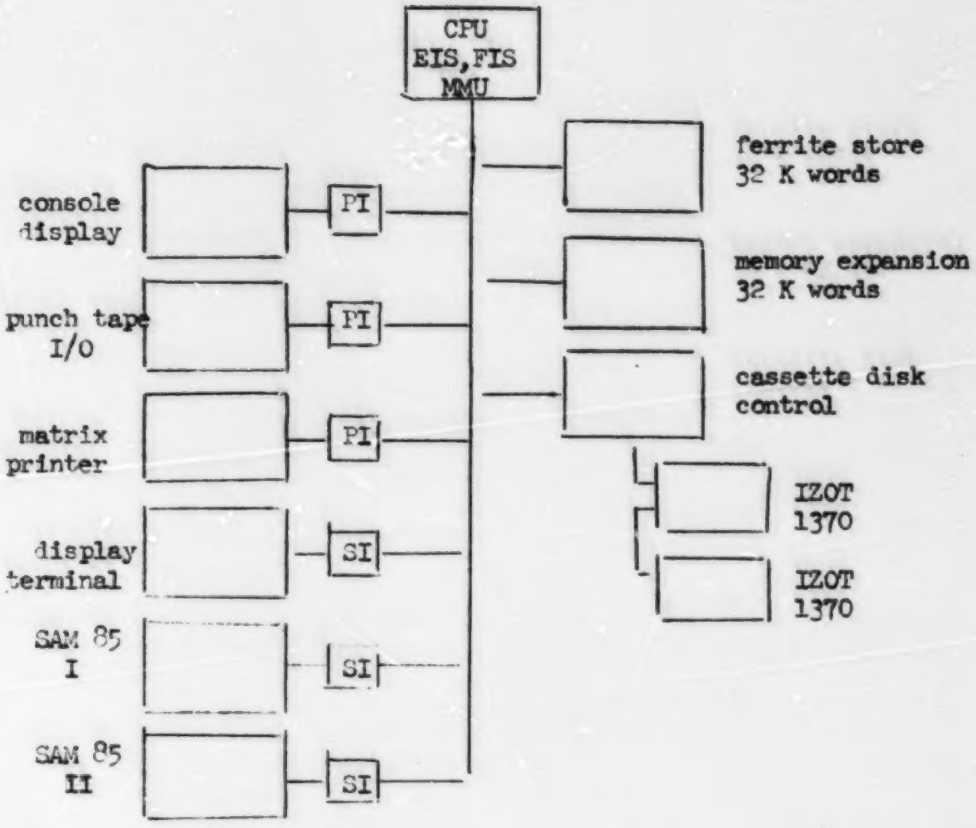

CPU
EIS,FIS
MMU
read only memory
console display
semiconductor memory expansion to 124 K words
punch tape I/O
cassette disk control
printer I
DK0-DK1
printer II
D2-DK3
dispatcher display
process adapter
quasi-graphic display
modem
remote display terminal
higher level link

Figure 2.



EIS -- expanded instruction set

FIS -- floating decimal instruction set

MMU -- Memory Management Unit

DK0, DK1, DK2, DK3 -- disks

PI and SI -- parallel and serial interface

--in the event of failure, one should think first of connector failures, then contact soldering failures and finally failure of parts.

In conclusion, I want to tank Szilard Vadasz, a department chief in the NOTO OSZV, who in several questions supplemented what I said with the following useful information.

--it is not good to move the circuit cards in and out because the gold-plating of the NYAK connectors gets worn off!

--over-heating of the cassette disks can be avoided if you take off the back panel, which stops the flow of air;

--the hanging up of the disks can be avoided if the OSZV experts tighten the screws sufficiently during maintenance, so the operators should not have to deal with this failure phenomenon.

The questions asked after the lecture pertained to compatible machines manufactured in the socialist countries, to the parts base for these, prices in comparison to the price of machines made domestically, etc.

I think that the answers given to the questions and those experiences about which I spoke gave a reassuring picture of the fact that the MSZR program of the CEMA countries has really begun and has fulfilled those hopes which the minicomputer experts attached to the appearance on the domestic market of the SM-4 machine category.

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CSO: 2502/26

VT 20 COMPUTER EVALUATED

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 81 pp 8, 9

[Article by Tamas Fodor: "The VT 20 And Its Applications"]

[Text] The program of the Alba Regia Days held in May every 3-4 years since 1964 always counts as an outstanding event in the life of Szekesfehervar. This tradition looking back over a few years is dwarfed by the thousand-year history of Szekesfehervar but it increasingly reflects the achievements of the city through social, political, economic, cultural, health affairs and sport programs.

Comparison With Videoton General Purpose Computers

	VT 20	ES 1010M	ES 1011	SM-52
Operational store (K bytes)	64	128	1,024	1,024
Disk (M bytes)	5-10	10-20	100-200	100-200
Number of magnetic tapes	—	4	8	8
Performance of line printer (lines/s)	300	600-1,200	600-1,200	600-1,200
Number of terminals	4	16	32	32
Time to add one word (microseconds)	4	1.75	1.75	0.6
Operating system	time segment	multitask	multifunction	multifunction ES 1011/PDT 11 operating mode
Prices (millions forints)	1-2	5-10	10-20	

Scientific conferences are not missing from these programs. The Fejer Megye organization of the NJSZT [Janos Neumann Society of Computer Technology] regularly contributes a conference to the program of the Alba Regia Days. Most recently, in 1978, the Computer Technology Factory of Videoton introduced its newly developed products, those which it is manufacturing and marketing in the present five-year plan. We have selected the VT 20 business computer which figured in the conference titled "The VT 20 And Its Applications" held on May 6 and 7 this time. According to experience thus far, this is arousing very great interest. As Dr Zoltan Marton, chairman of the Fejer Megye organization of the NJSZT, and I pointed out the VT 20 has an extraordinarily favorable price/performance ratio and is a computer developed for office and business applications of which 200 will be marketed this year.

Development of the computer began in 1978 and zero series manufacture took place in 1979. The entire system (hardware and software) was developed in Szekesfehervar.

On the first day, participants could become acquainted with the architecture and operating system of the VT 20. Laszlo Csapo, developmental engineer for Videoton's Computer Technology Factory, presented a block diagram of the system, the available peripherals and the technical characteristics (figure) and talked about plans for further development. Three speakers described the operating system--Karoly Csoti (monitor, data file management, system programs and utilities) and Csaba Tolvaj (index sequential data file management) are developmental engineer for Videoton's Computer Technology Factory and Tamas Tiszai (BASIC) is a programmer at the Kalman Kando Electrical Industry Technical College.

The chief services of the monitor, which makes possible the running of several tasks (a minimum of 5) independent of one another, are the following:

--loading and starting programs;

--modifying, transferring and recovering memory content;

--displaying memory content on the console screen;

--adapting logical peripherals to the physical peripherals;

--stopping at a given address;

--putting in break points;

--executing a program by cycle or by step;

--modifying registers;

--initiating and scheduling tasks.

It must be noted, however, that the monitor does not take care of resource management. Coordinating and distributing resources among tasks is the task of the programmer. The task of sequential data file management is management of the library on disk--source and object programs or assigning and storing sequential information as desired--and dynamic allocation of disk areas. The disk is broken down into basic units consisting of 16 secotrs and a data file is created by chaining basic units. The chained basic units are placed on various regions of the disk. It keeps track of occupied and free basic units. It ensures the opening, writing, reading and closing of data files.

The speaker reported briefly on the initializing, data file copying and library maintenance programs which belong to the systems programs. The library maintenance program makes possible recognition of the library catalog, the erasing of data files which have become superfluous and the modification of data files.

Assembler programs are created by an assembler translator and an edit-correct program which records and corrects source language programs and compiles source programs. The macroassembler can generate a relocatable and absolute format object program. The loader recognizes both formats. The utilities complete the operating system. The disk content modifying program ensures the display on the screen by sector of information stored on disk, and modification thereof. In the course of character chain search in memory or on disk, the program seeks in the given address content and displays together with the address the reference string. There is also a possibility for modification of it.

With the aid of a comparison program in the course of a byte by byte comparison of object programs on disk and in memory, differences can be listed on the screen or on the printer. In addition to the above, the object program which can be placed in memory can be saved on disk. Good aid in the solution of data-processing problems is provided by the DABAS, the system's index sequential data file manager.

The subroutine collection makes possible creation, modification and access according to keys of a data base of a given organization. The DABAS itself performs organization of the disk, the user does not have to deal with this. Keeping track of data records on the disk takes place according to keys. The keys can be 39 characters long. A collection of a maximum of 16 keys can belong to one collection of data records. The individual collections of keys are always ordered, and are ordered hierarchically in several levels. As a result of this system of ordering, any data record can be reached with five disk accesses.

The characteristics of the BASIC translation program for the VT 20 are very favorable (it takes up 16.5 K bytes). Its arithmetic and mathematical function library make it suitable for technical scientific calculations and its character chain management, its compatibility with the sequential data file manager and its index sequential data file manager make it suitable for solving data-processing tasks. It has the further advantage that assembler-level routines can easily be built into the BASIC programs.

On the basis of a commission from Videoton, the Mathematics and Computer Technology Institute of the Kalman Kando Electrical Industry Technical College ran a test on the BASIC. In the course of this they used a bench mark program on the basis of which the KFMI [Central Physics Research Institute] has measured the program running time of a number of systems used in Hungary. (The program can be found on page 14 of the September 1977 issue of COMPUTER.) We find these data below, supplemented with the running time of the VT 20:

The surprise of the first day of the conference was a report on and demonstration of a television information system. A VT 20 computer with a modulator on the central cable antenna system of Szekesfehervar--the best in the country and managed by the real estate management enterprise--broadcast a detailed program for the conference. Although the information system operated only for the 2 days of the conference, it well illustrated the limits of the application of the VT 20 computer.

Processor	System Version	Running Time
8080 micro P	LLL	90.0
ICC (8080)	ELTE-KFKI	27.0
TPA-1	Teasys MU (1 felh.)	141.0
TPA-1140	8K PT	3.7
ES 1010	IDOS	81.5
PDP-11/40	ES 1011	5.0
Tektronix 4051 (6800)	version shipped with system	40.0
PET home-computer (6502)	Microsoft	28.0
VT 20	version shipped with system	29.0

Margit Varga, program designer for the Computer Technology Experimental Plant Deposit Association, gave a talk on a floppy disk data recorder developed for the VT 20. The data-preparation system uses a format language to accelerate data recording and perform an efficient formal and logical check of the documents. With programs written in this very simple format language, the user can check the correctness of the documents (limits, arithmetic and logical operations, analysis of links between fields, comparison with lists, etc.). The format language makes possible automatic filling in of permanent fields on certain documents, the prescription of editorial instructions and programmed control of typing operations. The user can perform efficient preprocessing simultaneous with data recording thus reducing the number of information steps necessary to create an error-free data file. The data-preparation system is based on a VT 20 computer with a minimum of 40 K bytes of RAM. The background storage is an MOM [Hungarian Optical Works] MF 3200 floppy disk with a usable capacity of 256 K bytes but an IZOT 1370 disk of 5 M bytes can be used instead. The floppy disks serve the archiving of recorded data or pass it on for further processing. A write mode corresponding to the IBM 3740 makes it possible for the disks to be accepted by other computers in addition to the ES 1010M and the ES 1011.

Data are input with a special data-recording keyboard which has a separate numeric field. A screen displays the data. The screen is capable of displaying 24 lines of 80 characters each. The configuration becomes complete when supplemented with a printer.

The first step in executing any recording task is the writing and translating of a format program corresponding to the given document type. The writing of the format programs and the translation take place in the interactive mode. The translated format programs can be archived on floppy disk. After a valid sign-on procedure it is possible to initiate a format program developed for the document type to be recorded. The data go from screen to floppy disk under control of the format program. Following the first typing of any data packet, one can turn to

retyping for purposes of verification. Repeated input for purposes of comparison is necessary only for faulty fields designated in the format program. Correction of errors deriving from a bad filling in of the document, which were left in deliberately or by chance, and erasing or inserting what has become necessary in the meantime can be done according to the rules and possibilities of a separate correction procedure. Lists can be prepared from the data put on disk according to various viewpoints.

The speaker reported on a four-work-site version of the data-recording system, which will be put on the market by Videoton in the second half of this year.

Janos Kovacs, a department chief in the Computer Technology Factory of Videoton, then reported on a text-processing system based on the VT 20.

The VTEXT text-processing system makes possible convenient typing, storage, modification and simple reproduction of various written materials (documents, letters, reports, etc.).

Istvan Gonda, a software developer for the MEM [Ministry of Agriculture and Food] Technical Institute, reported on agricultural uses of the VT 20.

The changes which have taken place at specialized cattle sites--the development of maintenance technology and the level of production and especially the great concentration of stock--place increased requirements on leadership and guidance activity. The high concentration of stock requires programmed, even production guidance, which is also one of the ways to increase yields. Thus the use of computer technology and automated methods is appearing in the large-scale technology of cattle sites around the world. The MEM Technical Institute has prepared such a system on a commission from Videoton.

The services provided by the system are the following:

--forecasting certain technological events, from birth to first calving in the case of calf and heifer stocks and to next calving in the case of cow stocks;

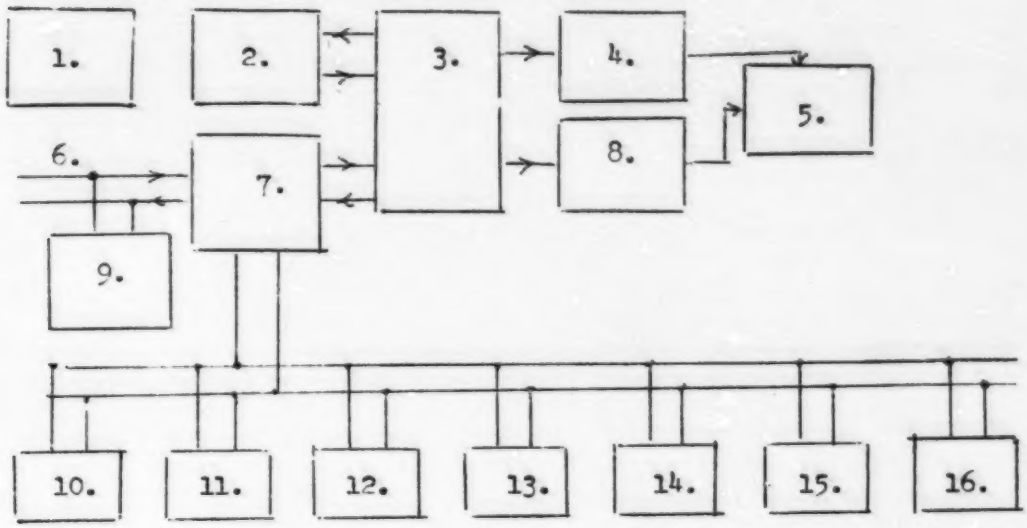
--subsequent checking of technological events and rescheduling of events missed;

--following production data. Taking weight measurement data as a base, one follows the daily or monthly growth of calves and heifers. By recording monthly milk-production data of cow stocks one can forecast milk production, deriving functions for finished lactations and calculating an index for balanced milk production (persistence);

--establishing a feeding system based on production data, developing an optimal ratio of bulk and seed fodders;

--preparing veterinary decisions and aiding medical work by processing health data;

--preparing records for the sites as a whole which show the distribution of the stock according to various "technological states" or production parameters; and



1. Power unit; plus or minus 5 V, plus or minus 12 V, plus 120 V
2. Display store; 4,000 characters; two direction scroll
3. Display logic; line or field organization; fields--normal, intensive, flashing, underlined, protected
4. Deflection
5. Screen--25 lines x 80 characters
6. Storage bar
7. Microprocessor--2 microsecond cycle time; 78 instructions; 8 IT control; RT clock
8. Video amplifier
9. CPU store; 64 K bytes--16 K ROM, 48 K RAM
10. Keyboard connection; Latin or Latin plus Cyrillic keyboard--standard typewriter arrangement, numeric field, automatic repeat, sound signal
11. Printer connection; DZM 180, B 300, VT 80 column or VT 132 column
12. Punch tape read and punch connection; TTL level, BSI interface, DT 105S, CT 2000
13. Floppy disk connection; MF 3200 MOM disk (1-4 units)
14. Disk connection; IZOT 1370, 5 M bytes (1-4 units)
15. Four-line group control; 4 single current duplex lines (asynchronous), 1-4 VSD simple displays
16. Data transmission unit; synchronous/asynchronous CCITT V 24 j. f. v. 20 mA current loop (max. speed 9,600 bit/sec)

—preparing statistical indexes aiding a planned elimination of stock.

Finally Dr Janos Mezei, a physician at the Fejer Megye Hospital, and Gabor Berkovich, a software developer for the Computer Technology Factory of Videoton, reported on health applications of the system.

A computerized records system for the blood transfusion station of the megye hospital was implemented as the first step of a computer technology program for the hospital, as one module of an integrated hospital data-management system. The basic task of the system is to keep computer records on the donors of the blood transfusion station, making possible quick selection of donors with the desired blood group. Another task is to prepare ad hoc and cumulative statistics on blood donations, selecting those entitled to recognition on the basis of the number of donations and providing more and more detailed information to the local Red Cross organization for its work in preparing for blood donations.

A speech by Laszlo Szlomka closed the conference. The chief of the commercial main department of the factory reported on prices and units manufactured, already mentioned, and turned to the service activity of the factory and the development thereof. In addition to the already existing customer service units in Budapest and Szekesfehervar, regional centers will be established this year in Miskolc, Szeged and Pecs and in 1982 in Debrecen and Szombathely. In addition to performing guaranteed repairs, they will have the task of hardware and software maintenance on the basis of contract, providing background machines, giving advice and preparing contracts and user software.

The conference was held in one of the architectural prides of Szekesfehervar, the House of Technology. A special VT 20 operated in the corridor beside the conference hall. The organizers—who came from the enthusiastic collective of developers—showed that programs and messages typed in or appearing on the console of the VT 20 could appear on eight television screens placed in the conference hall to help the speakers. During the recesses and after the talks, the developers provided detailed information on the VT 20 for those who wanted to get more detail on the system.

The hopes of the organizers were fulfilled. The great interest in the VT 20 was shown by the fact that the 250-seat conference hall was completely filled and a number of guests "took their place" on the steps.

8984
CSO: 2502/26

DEVELOPMENT, REQUIREMENTS OF COMPUTER INDUSTRY ASSESSED

Warsaw INFORMATYKA in Polish No 9-10, Sep-Oct 81 pp 4-7

[Article: "An Assessment of the Polish Computer Industry During the 1971-1980 Period and how this Industry Is Satisfying the Needs of Information Science"]

[Text] This report, requested by the Ministry of Science, Higher Education and Technology and the Ministry of Metallurgy and Machine Industry, was prepared during April and May 1981 by a team chaired by Prof Antoni Kilinski which included Doc M. Bazewicz, Doc Z. Bzymek, Prof A. Grzywak, Dr J. Gwiazda, Mgr Eng A. Musielak, Doc H. Orlowski, Prof S. Paszkowski, Dr W. Staniszkis, Prof W. M. Turski, Prof S. Wegrzyn, Mgr A. Ziaja and invited representatives of the Ministry of National Defense. In accordance with the orders of the ministries, the report assesses the development of the computer industry in Poland during the 1971-1980 period and the extent to which this industry had satisfied the needs of information science in Poland. A separate section of the report describes the development of the K-202 minicomputer.

At the start of the 1971-1980 decade, institutionalized efforts were intensified toward the comprehensive control of information science problems in Poland. These efforts, despite the often extreme importance placed on the accepted form of organization, were for the most part irrational because in the area of most importance--the development of useful information science applications--they did not go beyond pompous declarations.

Formally, in point of fact, the following were involved in turn with information science affairs:
The Plenipotentiary of the Government for Matters of Electronic Computer Equipment [PRETO], operating during the 1964-1971 period;
The National Office of Information Science [KBI], operating during the 1971-1975 period;
The Committee for Information Science, operating from 1975 to the present and, up to 1980, directed by the premier of the government;
The Government-Party Commission, operating during the 1973-1974 period.

The first two institutions (PRETO and KBI) had no influence--not even formally--on the activities of the computer industry. The Committee for Information Science was

solely a propaganda institution devoid of executive power, and the Government-Party Commission involved itself primarily with personnel matters and produced nothing more than general declarations.

Whatever the chances were for the comprehensive treatment of information science problems, they were decisively squandered when the information science tasks were divided among different ministries. An expression of such a division was Decision No 3 of 11 January 1974 of the Presidium of the Government which assigned responsibility for:

--the production of computer hardware and basic software to the Ministry of the Metallurgy and Machine Industry;
--the production of utility software to the Ministry of Sceince, Higher Education and Technology;
--the production of operating material to the Ministry of Chemical Industry and the Ministry of Forestry and Timber Industry;
--the production of data communications equipment and the development of a computerized-information network to the Ministry of Communications.

With such a division, no state organ was factually responsible for the proper development of applications which, according to the official doctrine, were supposed to be a derivative activity of the production ministries which, in turn, were guided by their own economic indices. The separation of software production from hardware production was a characteristic feature of the above division of tasks. As a result, in Poland during the 1976-1980 period, basic economic activity in the realm of information science did not occur in general, that is the delivery of computerized-information systems consisting of hardware and their own software.

Because it was not in the forefront of any important auxiliary activities (soliciting and consultation), the computer industry was completely devoid of natural incentives for development that fashioned similar industries in the world (not only in the Western countries but also in the Eastern countries, for example, the GDR), it did not develop as designated, that is, as the result of two forms: technical progress and customer requirements; instead its development was determined by economic indices that were more or less arbitrarily established.

In addition to the conceptual shortcomings of the state's information science policy, other shortcomings occurred during the 1971-1980 period that evolved from the general disorders of our economic structure.
--The parochialism of the ministries. The ministries, branches and enterprises having greater "breakthrough force" obtained at times very significant resources to create computer centers in their central offices. Unfortunately, the higher schools are subordinate to ministries having a small "breakthrough force" and, as a result, the higher schools are equipped with information science equipment which is much worse than that in the central offices and central associations, which is a curiosity on a world scale. Similarly, such activities as health protection, social service on a mass scale, education and so forth also had a small "breakthrough force."

--The ostentatiousness of information science applications. Many completely good computer systems were installed for prestige reasons without proper preparations and without honest analyses of suitability. These systems, which lacked source data

and had software that was not adapted to Polish realities, served primarily to demonstrate modernity and as objects to boast about before guests.

--The nonimplementation of accepted economic programs. This was especially detrimental to the development of the computer industry. For example, by Decision No 3/74 of the Presidium of the Government, 11 billion zlotys were approved for the computer industry, but of this amount barely 3.5 billion zlotys were received by the computer industry during the 1971-1980 period; the projected production of magnetic data carriers was never initiated; and programs for the production of electonic components are systematically delayed and unrealized with regard to assortment and quality.

Since 1975, information science applications in Poland have been consciously delayed by categorizing hardware as capital goods. Since that time the number of installed domestic and imported computers has decreased.

The phenomenon of a decreasing number of new computer installations is not happening and has not happened in any other country in the world. The imposition of high accumulative allowances on the computer industry (yielding only to the accumulative allowances on alcohol distillers) has created a unique situation in Poland in which the state places a high de facto tax on information science users. In most countries tax abatements are favored instead.

Research and Development Facilities

Information science is an activity that especially requires systematic preparations of scientific, training and technical facilities.

Since the start of the 1970s, the principle regarding the lead-time development of facilities and cadres relative to economic activity (production and applications) in the area of information science has not been properly heeded. This is one of the primary reasons why many applications have failed and why hardware purchased from the capitalist countries has not been used efficiently.

The inadequate or old computer equipment of the higher schools and the inadequate development of industrial research-development facilities were serious mistakes of that era. Quantitatively, such MERA [Automation and Measuring Apparatus Industry Association] facilities employed, together with employees of the Experimental Centers, 3,150 people in 1971, compared to 4,500 in 1975 and 3,260 in 1980. Many employees involved in production or customer service were considered to be OBR [Research and Development Center] personnel and even as employees of some institutions. As a result, technological research and technical equipment development were almost completely suspended, relying on the import of licenses for prepared technological equipment. In contrast to our policy, the other CEMA countries, especially the GDR and Bulgaria, increased their facility employees several times over during this period.

In general, it can be stated that there were insufficient numbers of information science scientific-research and scientific-training facilities in relation to projected production goals and applications.

The Computer Industry

During the 1971-1980 period, the major portion of Poland's computer industry was grouped within MERA, which is subordinate to the MPM [Ministry of Metallurgy and Machinery Industry]. However, the role of UNITRA [Electronics and Telecommunications Industry Union], the primary supplier of components for the computer industry within the MPM, should be remembered.

As a result of implementing the information science policy, Poland's computer industry did not satisfy most of the country's needs, even in the "better" years 1971-1975. Then again, its existence was threatened during the 1976-1980 period. In defending itself against this threat, the computer industry assumed a notably proexport strategy for development and production. During the 1976-1980 period, domestic deliveries of Polish computer hardware was limited to about 20 percent of the value of this industry's production. Production based only on a level of established limits for domestic deliveries was not economically justified.

The ratio between exports and domestic deliveries deteriorated year after year and was the reason for the progressive isolation of Poland's computer industry from the problem of information science applications in Poland. At the same time, this industry was treated more and more as a subsection having to finance the nation's balance of international payments.

Limitations on investments, employment and coproduction deliveries brought about the nonfulfillment of projected production capacities, the nonapplication of planned technologies, and the underdevelopment of scientific-research facilities and service.

The mentioned reduction of employment in MERA's scientific-research facilities and the samll and limited production of computers made it impossible for this industry to make real progress in production and, in many cases, making it unprofitable to implement technological changes and impossible to develop in a reasonable time frame many required programmer tools and configuration extensions.

During the 1976-1980 period, the computer industry did not obtain deliveries of the electronic large-scale-integration (LSI) subassemblies, including semiconductor memories and microprocessors, that were agreed to during the 1973-1975 period (and taking into account when the licenses were purchased). Polish electronic subassemblies used in Polish-produced hardware are an indication of the level of its modernity and reliability and are decidedly worse compared with modern hardware based on LSI subassemblies. MERA products based on LSI subassemblies, for example, the MERA 100, MERA 200, LX 2010, LX 2020, LX 2500, NUCON 400 and other microcomputers, were in general not available to domestic users or were available only on a small scale because they used subassemblies imported from the II payments area [capitalist countries] and were intended for export to the II payments area or for Polish consumers as a return on their foreign-exchange input.

In effect, the industry adapted a proexport mode of operation developed during the 1976-1980 period which was based on the large-scale production of peripheral equipment primarily for export within the framework of Poland's specialization within CEMA. The export of information science equipment was the most profitable export of the electromachinery industry during the 1971-1975 period, during the 1976-1980

period whole computer configurations were not exported on a large scale because during this period all CEMA countries were beginning to produce their own systems, satisfying the needs of their own domestic users; they permitted supplementary imports into their markets only in special cases. Poland's computer industry took advantage of these special cases and exported several systems each year during the 1976-1980 period.

The licenses applied and purchased during the 1972-1976 period initiated the production of several new products, for example, mosaic printers, printer-based terminals, cathode ray tube (CRT) monitors, floppy disk memories, systems to collect and initially process data, and a microcomputer system to control machine tools and multioperation machine tools. Nonetheless the limitation of dliveries to domestic users and the fact that it was necessary to import electronic subassemblies in conjunction with these new licenses meant that Polish users did not receive this equipment in sufficient numbers to satisfy their needs.

The post-license development of these products during the 1981-1985 period will permit the production of modern microprocessor-controlled printers, a whole family of CRT monitors, double density floppy disks and specialized microprocessor-controlled terminals.

It must be admitted that the licenses purchased by the computer industry were successful. They are generating significant benefits, for example, character-mosaic printers and floppy disk memories.

Poland's cooperation with the socialist countries, realized within the framework of MKETO [International Commission for Matters of Electronic Computer Equipment], initiated the specialization of production and, at the same time, extended the production series and lowered equipment manufacturing costs. Specialization enables production to be concentrated in several selected assortment groups and, at the same time, computer configurations to be prepared in accordance with user requirements owing to the import of other assortments purchased with foreign-exchange funds earned from exports. This potential benefit of cooperation was not utilized because the Planning Commission limited foreign-exchange allotments for imports from the capitalist countries during the 1976-1980 period. The granted annual foreign-exchange allotments were not sufficient to import equipment to complete the systems equipped with Polish processors (for example, there was a lack of Bulgarian disks, GDR card readers and the like).

The lack of a modern subassembly base, expecially during the 1976-1980 period, and the lack of high quality components during the entire decade produced two negative results:

--high-cost hardware;
--relatively low quality of computer systems compared with those produced by the leading capitalist countries in this field.

As a result the following occurred:

--users intensely solicited allotments to purchase foreign hardware when those same foreign-exchanges funds, if used to purchase subassemblies for the computer industry,

would have provided a greater number of good equipment for Poland (such as occurred with the MERA 9150, a device produced partially with the purchasers' foreign-exchange funds);

--the computer industry started producing hardware for applications in real-time systems, especially for process-control systems, only to the extent to which it could count on subassembly imports from the capitalist countries. It realized that the quality of hardware produced from Polish components would not be adequate. It should be emphasized that the comparison of Polish products with products from the II payments area is negative with respect to cost and quality, but when compared with products from the other CEMA countries the products of our industry are decisively better.

Despite the mentioned limitations that resulted from the computer industry's realized proexport policy, the industry did expand production during the 1971-1980 period as shown by the figures presented in the tables and charts below.

Table 1.

Table 1

1 Produkcja globalna (sztuk)	1971	1976	1980
2 komputerów	56	105	70
3 mini- i mikrokomputerów	0	360	352
4 urządzeń zewnętrznych	1675	6140	19187

Key:
1. Total production (units)
2. Computers
3. Minicomputers and microcomputers
4. Peripheral equipment

Table 2.

Table 2

1 Produkcja na kraj (sztuk)	1971	1975	1980
2 komputerów	32	97	49
3 mini- i mikrokomputerów	0	345	298
4 urządzeń zewnętrznych	1139	3665	6247

Key:
1. Production for domestic use (units)
2. Computers
3. Minicomputers and microcomputers
4. Peripheral equipment

Figure 1.

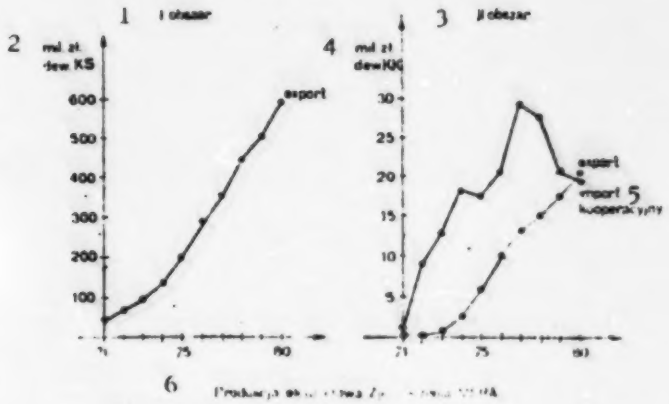


Figure 1

Key:

1. I payments area (socialist countries)
2. Millions of foreign-exchange zlotys of the socialist countries
3. II payments area (capitalist countries)
4. Millions of foreign-exchange zlotys of the capitalist countries
5. Coproduction exports
6. MERA's export production

The significant preponderance of coproduction imports from the II payments area over exports to this area during the 1971-1980 period resulted in part from the application of licenses but mainly from UNITRA's delayed production of subassemblies. In 1980 a favorable balance was achieved in the settlement of accounts with the II payments area.

Despite the generally difficult conditions of the generally unsatisfactory deliveries to domestic users, the computer industry realized specific product [goods and services] achievements during the 1971-1080 period, for example it:

--expanded MERA-ELWRO's production capacity to a volume of 300 computers annually;
--developed and produced a series of ferrite operating memories for JS i SM EMC [Uniform System and Minicomputer System of Electronic Digital Computers];
--developed and initiated production of the MERA 60 minicomputer;
--developed a MERA 60 flotation-process-control system and a MERA 80 microprocessor-controlled system for textile machines;
--developed a system based on the MERA 400 to control personnel movements in the Siersza mine;
--developed the SAD and SWINTET data-base systems for JS EMC computers;
--developed the MERA 400 minicomputer;
--developed the SOM-5 operating system;
--developed and initiated production of tape memories;
--developed a number of automation and measurement systems provided to users as so-called turnkey deliveries, for example, to the Labeda mill, to MERA-ELZAB and to the Medical Academy in Katowice.

The Computer Industry and Satisfying Poland's Information Science Needs

In accordance with centrally adopted resolutions, the computer industry was responsible for hardware and basic software deliveries and computer services. It was rationally assumed that a country of Poland's size could not produce the full assortment of hardware required by information science, and thus specialization and exchange within the CEMA framework were implemented. The appropriate resolutions assuring Poland's information science needs were passed at the MKETO forum. Unfortunately the results of the computer industries of the countries associated with MKETO were worse than the results of our own computer industry regarding scheduled production of new products, their prices and, in many cases, their quality. It was espcially unfavorable for large capacity disk memories and computer graphics equipment.

As a result of this and the fact that the limitations on independent purchases of equipment from individual CEMA countries were obligatory in Poland, it was not possible to complete systems, including real-time systems, according to user needs.

During the 1976-1980 period, the Planning Commission started limiting computer hardware deliveries to domestic users as capital-goods deliveries. The limitation was twofold: the total sum of the deliveries was calculated in zlotys, and the nominal distribution list of computer customers was confirmed by the Planning Commission each year. This meant that MERA, in working out a directive type distribution list of computers for domestic users, had to include in it the amount of deliveries for a given year, and in effect the lack of correlation between the amount of deliveries and the number of users brought about configuration deliveries that did not meet user needs. For these same reasons it also was not possible to expand previously delivered configuration in accordance with user needs.

Customers who had a choice either to purchase framework configurations or in general to depend on the Planning Commission's distribution list chose the former. As a result the number of computers installed in Poland that were counted as "units" increased, but the increase in computation capability was disproportionately small in relation to the incurred outlays.

It should be noted that the configurations supplied by the computer industry were unsuitable not only with regard to utility system requirements but also with regard to software requirements and capabilities.

The investment restraints on the computer industry during the 1976-1980 period held the technical base of service to its 1975 level, which caused the already unsatisfactory service to decrease significantly even as the number of installed user hardware increased. The quality of the administered component base, the continuing shortage of subassemblies and the applied technologies, despite the notable efforts of the computer industry (mainly ELWRO) to improve hardware reliability, produced imperceptible results as far as the users were concerned.

Software

In Decision No 3 of the Presidium of the Government, which was mentioned in the introduction, the computer industry was unjustifiably excluded from software production activities. Also, the obligatory system of economic indices was an

effective counterstimulus for such activities. Because the report concerns only the computer industry, only basic software is discussed in the section below.

The software of the world's major computer companies is not completely compatible with Polish hardware; the development of programs by individual computer centers was not undertaken on a national scale in an organized way and, as a result, an organized exchange of programs among computer centers did not take place. The development of programs in an unorganized way by some computer centers outside the computer industry does not change the factual state of affairs.

Production of ODRA 1300 and R-32 computers meant that computer producers did not have to develop completely new basic software on their own. Software for the ODRA 1300 was appropriated from the ICL 1900 computers and for the R-32 from the IBM 360/370 computers of the socialist countries. The computer industry operating in the then current economic conditions (which recognized only the production of hardware as directly productive work and work on software as a sideline work) severely limited work on software. Meanwhile, in exploiting the compatibiliity of our hardware with the hardware of the major world firms, after the suitable software was accepted when production was initiated, we should have worked on our own software. This expecially concerns the R-32 computers. As is well known, IBM's software for the 360 and 370 computers has many advantages, but it also has one basic shortcoming, that is, for efficient operation it requires additional hardware, expecially large operating memories. Meanwhile, the hardware configurations delivered to users by the Polish computer industry or that were imported were very modest owing to material shortages. Thus they operated much less effectively with the IBM-adapted software than they could have operated with basic software developed in Poland, on which a very limited amount of work was done.

In its attempt to fill in the gap in the minicomputer market caused by the fact that K-202 minicomputers were not serially produced, MERA 300 minicomputers were sold before adequate software was prepared for them. Before the computer industry or the users could generate this software, the MERA 300 turned out to be so obsolete that its production was justifiably discontinued.

In the basic software for the MERA 400, compatibility among operating systems was not such that existing software could operate with the newer, better operating systems. As a result, the large collection of library programs and the translators developed for the SOM-3 operating systems cannot be used with the more efficient SOM-5 and CROOK operating systems.

Conclusions

Computer applications are an essential and strategic element of a rationally functioning national economy. They are necessary to provide information services to the people, to control technological processes, to assist management, and as aids for defense tasks, scientific research, training and so forth. Most technological equipment must be equipped in the near future with microprocessor-based controls.

--Above all, existing computer and minicomputer configurations must be supplemented with such hardware and software so as to assure better service and supplies of spare parts, even at the cost of discontinuing the production of new computer installation over the next several years.

--Special emphasis should be placed on minicomputer and microcomputer applications because outlays for these applications are lower and implementation times are shorter.

--The modernized JS and SM EMC equipment and microcomputers should be the preferred lines for further development of computer systems in Poland. This is in accord with economic prerequisites, CEMA resolutions and the immense experience gathered in Poland by original system users and by industry. We should develop our own software for this family of computers, making optimum use of our hardware's capabilities and the current state of the art in the world.

--To effectively use the potential of the ODRA 1300 systems now in Poland, it is necessary to guarantee its users parts and equipment to operate with optimal configurations.

--Inasmuch as the computer industry is one of the most efficient industries in the world (it uses very little energy and raw materials but requires much brain power), it should be expanded in Poland, becoming one of the export specialties.

--The export of computer services, software and specialized turnkey computerized-information systems are the most profitable; thus far this export has not kept pace with Poland's potential and it should be intensified.

--The computer industry's export specialization should not be at the expense of domestic user needs.

--Guaranteed access to modern LSI and very large-scale integrated (VLSI) electronic components and subassemblies is a necessary condition to expand the computer industry's production and to assure the proper reliability of its products.

--Adequate research facilities, deliveries of spare parts and a well organized and equipped training base for users as well as service personnel are necessary conditions for successful domestic applications and export of computer systems.

--The excessive and unjustified accumulations imposed on computer hardware and services are a deterrent to the expansion of the rational application and production of computer hardware.

--New and modern computer hardware should be installed in all the higher schools with sufficient lead-time to guarantee that the new generation of workers in the economy will know how to build information systems effectively and how to take advantage of them, and also to guarantee the investigation and expansion of applications of newly produced products.

--To avoid in the future the shortcomings that afflicted Polish information science and the computer industry during the 1971-1980 period, the following procedural principles must be observed.

--Acknowledged resources must be adequate to meet designated goals or else the goals must be changed. The principles that "somehow it will work" and "shift for yourself" cause waste and nonachievement of goals.

--From the point of view of social needs and use of completed investments, the functionality of delivered systems is what is important, not the amount of produced "iron." The limitation on the employment of customer service personnel, designers and programmers by the computer industry to benefit workers producing material and energy is also harmful.

--The number of installed computer configurations is not important; what is important is their reliability and completeness relative to user needs and utilized software (the creation of optimal configurations is not of any concern here).

--The economic mechanisms must also be worked out so that coproduction for a producer of finished products (for export) would be more profitable for the component producer than the direct sale of these components. Otherwise the production of systems for export, which is especially profitable, will not expand.

--Committed assignments must be complied with completely, especially those concerning economic organizations. An example of an intolerable situation is when the MPM accepted the proposal concerning MERA's purchase of a license which involved the coordination of supplies from UNITRA which subsequently changed UNITRA's plans.

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END

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13 January 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 728

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INFORMATION INDUSTRY FINDS NEW APPLICATIONS

Paris ZERO UN INFORMATIQUE HEBDO in French 16 Nov 81 p 16

[Article by FT: "A Hungarian Individual Computer"]

[Text] Presented last week at the Center for Information on Hungarian Technology, the HT 680x microcomputer offers interesting possibilities for digitization and graphics.

Specializing at first in video and television, the Hungarian Cooperative for Telecommunications (HTSz) perfected, one and one-half years ago, the HT 680x individual computer: a modular system built around Motorola's 6800 microprocessor. Its 32K main memory can be expanded to 512K with the addition of eight RAM boards.

An adapter makes it possible to connect the system to an ordinary tape recorder for a rate of 1200 to 2400 baud.

The alphanumeric viewing unit, located above the ASCII keyboard, displays 24 lines of 64 or 80 characters.

Several peripherals can be connected to the HT 680x. Among them are: two matrix printers of the type DZ M-180 or Daro 1156, an adapter for tape cassettes, a punched tape reader, a plotter, and a color graphics terminal.

Its operating system is the DC DOS, and it supports the V 24 and IEC 625 interfaces.

A compiler for BASIC should be completed within six months.

Microscopic Images

The major advantage of the HT 680x is its capability for recording and processing images.

The system is capable of introducing and storing in memory, images from a television camera, and of transmitting them from one monitor to another within 11 seconds. Four different photos can be reproduced on the same screen, and enlarged separately.

Placed directly on a microscope, the television camera can transfer to the system the image to be processed. This is intended primarily for biologic and medical applications (histologic sections, exact determination of blood samples), as well as for the physics of metals.

In the same way, the treatment of infrared images is used for medical diagnostics and industrial applications.

The Hungarian National Institute for Neurosurgery uses the HT 680x to analyze the spontaneous electronic activity of the brain and central nervous system, as well as electrical processes in muscles.

Most of the system's applications involve domains in which the treatment and handling of images are necessary: architecture, civil engineering, electronics, cartography, processing of satellite images, geology, oceanography, and so on.

The HT 680x is exported by Metrimpex, a Hungarian foreign trade company for instrumentation, which works with Sems, CII-HB, and Thomson-CSF.

In the EEC, it is distributed by Sertel (Company for Services in Teleinformatics and Telecommunications) at a price of 50,000 to 150,000 FF, depending on configuration.

11,023
CSO: 3100/145

NEW COMPUTER DEVELOPED, DATA PROCESSING INDUSTRY GROWS

Paris ZERO UN INFORMATIQUE HEBDO in French 23 Nov 81 p 29

[Article by Bohdan O. Szuprowicz]

[Text] Because of the investments made during the 1970's, the value of the data processing inventory installed in Hungary multiplied eight-fold during the last decade, with an average annual growth of 26 percent; but the role played by Riad hardware from the Soviet block is decreasing steadily, as in the other East European countries.

At the end of 1979, Hungary had 1163 computers of all sizes, with a total value of about 800 million dollars, calculated at the official exchange rate for the Hungarian forint. This is obviously a very clear progress compared to the 127 systems--evaluated at 100 million dollars--which existed in 1970; but the present figures are well above worldwide ones.

Although the rate of introduction of information processing in Hungary has been relatively higher than that of the Soviet block during the last twenty years, it has still not succeeded in reaching that of countries outside the COMECON. And the number of installed computers per million inhabitants in Hungary is only 20 percent of that found in EEC countries.

Underutilized Systems

In 1979, Hungarian computers have supplied about two million machine hours, which amounts to an average of only 1700 hours per machine per year. This might lead us to think that two-shift utilization must not be very widespread in the country, but a report from the Hungarian Administration for Data Processing Applications indicates that in fact, the some 500 computers which represent the bulk of the installed computing power, operate with an average of two shifts per day; we must conclude that the systems which compose the remaining 60 percent of the computing power, are mostly underutilized.

Of the 1163 installed computers, only two are classed as large systems. Small computers represent 38 percent of that number, and intermediate ones 17 percent. The largest percentage is represented by miniprocessors and minicomputers, which amount to 44 percent of the total, and whose number is growing more rapidly than any other category.

Today, one of the largest machines in Hungary is an EC-1055 Riad system from East Germany, whereas this title once fell to western imports such as IBM 370/145, ICL 1904, and CDC 3300, who in turn had to share the distinction with the huge second generation Soviet Razdan-3.

Hungarian information processing employs more than 21,000 persons, among which there are nearly 1400 system analysts and 2700 programmers. The remaining are operators, maintenance personnel, and data preparation employees.

Industry First, Education Next

By far the largest amount of machine time is used, as elsewhere in Europe, for traditional tasks; inventory control and resource allocation applications follow far behind; and software development, production control, process control, and scientific calculations, each occupy an equal proportion of machine time. Training involves only 3.2 percent of this time, but since the machines are underutilized, this time could clearly be increased if necessary.

Nearly one-third of the computers work in industry, but a sizeable one-fourth are installed in educational organs which provide services for various organizations. At least 20 machines, for instance, operate in different units of the Minstry of Education alone.

This situation results from the fact that educational organs were the first to install and use computers, at a time when the necessary training was not very widespread.

This dependency of information processing on academia is becoming perennial. Public administration, health, and other public services follow in third position.

Domestic and foreign trade enterprises, as well as transportation and communications for industry and construction, each use at least 10 percent of Hungary's computers. Forestry and agriculture are the sectors of the economy least involved in data processing.

Soon, a National Network

The Central Office for Statistics controls the National Organization for Accounting and Electronic Data Processing (SZUV), which manages information processing centers in Budapest and at 13 regional bureaus; by 1985, it plans to extend this service to 19 centers throughout the country. It is the largest organ of information services in the country, with over 800 employees and a gross business of about 40 million dollars per year. SZUV started in 1960 with a Univac 1004, and in 1966 imported an ICL 1904, at the time the largest system in Hungary.

The trend in recent years has been to install Riad machines, which replace the old western imports and the Polish Odras. Thirty Riad computers are already in service, most of them EC-1002 and EC-1020. Very few machines operate in time sharing, and batch processing is the rule, but SZUV plans to eventually interconnect all its centers into a national network.

Szamok, the National Center for Management Planning, is responsible for basic data processing training, and today places emphasis on small computers: EC-1010, EC-1020, EC-1022, EC-1030, EC-1032, Hungarian designed TPA minicomputers, and a unified series of SM computers manufactured in Russia.

Szamok publishes two periodicals in the field, SZAMITASTECHNIKA and INFORMACIO-ELEKTRONIKA, which keep the Hungarian data processing community informed of the latest technologic progress.

Role of Institutes

Several technical institutes are developing material and software for industry, and cooperate with the COMECON Riad program.

Among the hardware we find Hungarian TPA minis, EC-1010 and EC-1050 Riad computers, CRT terminals, and the graphic terminal GD 71, which was developed in Hungary after the exportation of a similar terminal from the United States was refused a few years ago.

In terms of software, the institutes have perfected a COBOL compiler and most of the operating systems of their computers. A national information processing organ, Noto, takes care of maintenance, spare parts, and service for all of Hungary's computers, including western imports, whose number is rapidly decreasing.

Thus, if the Hungarian information processing industry is relatively well organized, and if its progress can be considered satisfactory with respect to the goals and achievements of the 1960's and early 1970's, it is nevertheless from now on, resolutely turned toward the east.

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DECREE REGULATING BUDGETED RESEARCH SITES EXPLAINED

Budapest FIGYELO in Hungarian 2 Dec 81 p 5

[Article by Dr Zsolt Aradi: "Financial Management of Budget-Financed Research Sites"]

[Text] A recently promulgated decree of the minister of finance regulates as of 1 January 1982 the financial management and incentive system of budget-financed research sites (research institutes, and also universities, colleges and numerous other institutions that perform research not as their exclusive basic activity but as a sideline). The new statutory provisions affect not only research sites, but also other state-controlled managing (or coordinating) organizations that commission research work for the state, and enterprises that maintain contractual relations or partnerships with research sites.

Uniform Consideration, Classification

In the course of evaluating the realization of the MSZMP Central Committee's Science-Policy Directives, specific provisions of financial regulation also were justifiably criticized. A summary evaluation of this kind states, for example: "The present system of financing and financial management has created different self-interest relationships at the independent research institutes that function as enterprises or are budget-financed, and at university research sites. In some areas the system does not provide proper orientation. It does not stimulate adequately concentration on preferential topics, while in other instances it provides too much incentive for services and production." The critique has clearly demonstrated that the incentive system of the different types of research sites must be streamlined, continuously and in a coordinated manner. This task had to be solved also in the course of elaborating the new system of financial management for budgetary organs.

Drafting of the new statutory provisions was preceded by an extensive survey of the existing situation, and the obligations are laid down in cabinet-level documents. In spite of this, the considerations of science policy, research management and financial regulation could be asserted only after much debate, and in some instances merely on the basis of compromises. With the promulgation of the decree, the same basic statutory provisions apply to the financial management of every type of budget-financed research site (i.e., to research institutes, universities, etc.) and to research commissioned by the state. This permits the application of a uniform system of criteria, to the extent that this is warranted. In principle, then, the provisions differentiate not by types of research site, but by tasks.

Regulation that influences development of the research sites' specific (research and other research-related) activities necessitated the clarification and definition of certain research-management concepts and regulations. For example, redefinition of the concept and scope of basic activity, and of work outside such activity, conveys the fact that "contractual work" actually corresponds to a practice of financing under which the research-managing organization or customer specifies in writing the research task, but this task does not necessarily provide a profit. Clarification of the role that "controlled" research plays in the life of budget-financed research sites likewise became an urgent task.

The statutory provisions rank the research sites' individual activities in the order of their importance. The most valuable activities are: commercialization of research results, transfer of research results for commercialization, contractual research for the applying production organization under which the profit and risk are shared, and tasks included in programs of special importance. This classification is very important, because also the system of material incentives is linked to it. Preferences may be assigned if research-management decisions unambiguously attribute special importance to the activities, to the extent that this is sound also on the basis of socioeconomic considerations.

Research Commissioned by the State

The decree regulates research commissioned by the state. It defines the circle of tasks for which a commission from the state is required, and which must be given priority. These are: tasks of the OKKFT [Orszagos Kozponti Kutatas es Fejlesztesi Terv; National Central R & D Plan], research tasks of the branch, etc. target programs, and a few tasks at the ministry level. Since construction of a new system was involved, many details also had to be regulated. Thus the statutory provisions define the circle of organizations that may commission research (for example, the program bureaus), the content of the commission, the relationship between the general contractor and subcontractors, the coordination of professional evaluation and financial accounting, and numerous questions of financial settlement. The state commissions research tasks of special national importance, and therefore the provisions regarding the organization of research are supplemented also by incentives. In the case of research whose incentives are linked to the unspent balance (in the social sciences, for example) this provides an opportunity to grant additional bonuses, over and above the budgetary allotment for bonuses. In the case of research to which the profit incentive applies (for example, technical or agricultural research), realization of a specified profit is the source for material incentives. Since research commissions from the state cover a period of several years, the financial, personnel, etc. conditions of fulfillment are specified for the given period, and provisions had to be made also for annual incentives. As a result, research is expected to be better organized, its fulfillment will be simplified, and --highly desirable--the costs and incentives will be linked more closely to the actual results of research and development.

The purpose of defining the conditions under which research sites may undertake, from customers other than the state, research that is outside the scope of their basic activity is to "protect" the basic tasks (for which the institution was established), respectively the institution's budget. The priority of the preferential R & D tasks does not mean that fulfillment of the enterprises' everyday needs must

be cut back completely. However, research capacity must be utilized more efficiently than up to now, and therefore the regulators must stimulate development of more expedient proportions.

Profit Incentive

An important part of overall regulation is regulation of the profit incentive, i.e., the formulation of rules according to which the research sites manage their profit. Profit may originate from the proceeds of many different activities. For example, contractual research performed for enterprises, commercialization of research results, or other production-related research commissioned by the state. Such research may be financed from various resources, including also budgetary subsidies. This serves to provide more material incentive and simplify regulation. The differences between the proceeds and costs are consolidated (annually) for the institution as a whole and may include also losses on individual research projects. (Within the framework of its internal incentive system, of course, the institution may employ profit-and-loss accounting by projects and direct incentives, but this must be solved within the institution's own rules.)

Under the profit-incentive system the uniform level of criteria manifests itself in that the price forms applicable to the individual types of budget-financed research sites, their principal normative cost items, the principles of cost accounting, the method of determining profit, the forms and rates of sharing profit with the state budget, and the modes of allocating and spending profit are identical. All this serves to approximate the regulations applicable to the research sites that function as enterprises, while avoiding unwarranted standardization.

Under the uniform system, only one distinction is made between the different types of research site: in view of the fact that the so-called other research institutions (for example, the universities) perform also educational, medical, etc. basic tasks and offer a level of personal incomes generally higher than at research institutes (this difference had to be preserved), pay for research performed in addition to regular duties is not affected by profit regulation.

An essential consideration in the changeover to the new system is that the average level of personnel incomes must not decline. It is estimated that this requirement will be met through minor shifts in the average level of personnel incomes between institutions, in the warranced direction (assuming that all other external factors remain unchanged). Total transfers of revenue to the central government will not increase in relative terms. The decree of the minister of finance does not set absolute limits on personal income--neither on the amount payable per person, nor on the total bonuses per institution.

Reflecting the government's science-policy efforts, the regulation simultaneously sets differentiated conditions as well. Material self-interest must differ in accordance with what type of activity (preferential or other) the institution conducts. This is ensured through transfers of revenue to the supervising organs (these transfers may differ by types of research tasks), and through the so-called indirect incentives. These indirect incentives include the provision that the allocation of the institution's profit favors personal incentives (the profit-sharing fund) if the research site conducts a larger proportion of activity that is more valuable from

the viewpoint of science policy. The tax benefits that may be granted in taxing the profit-sharing fund are based on the same principle. From all this it follows that the incentive funds can be greater than at present if the research site accepts research tasks with due consideration for their importance from the viewpoint of science policy. Within the framework of the profit incentive it is also possible to provide some recognition of basic research.

Role of Regulation

Even this brief outline conveys the statutory provisions' topical diversity, and also the efforts to streamline the structure of the research sites' activity under a uniform system of requirements and differentiated incentives (so as to increase the proportion of research that is of special importance and of proven economic value), and to make efficiency the primary consideration when choosing research sites for the research tasks.

The decree of the minister of finance sets the most important conditions for meeting the specified requirements. It does not formulate a detailed solution for every problem and task, because it cannot take into consideration all the peculiarities of each sicence, type of research site, and supervising organ; the diversity of the research endeavors rules this out. For this reason the realization of science policy, the efficient use of the available conditions, the functioning of the research sites and scientific research within a uniform regulatory framework will depend to a significant extent on the ministries that issue more detailed regulations, on the managers of research and--last but not least--on the researchers themselves.

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REMOVAL OF SOLVENT FROM WASTEWATERS OF THE PHARMACEUTICALS INDUSTRY BY MEANS OF DISTILLATION

Budapest MAGYAR KEMIKUSOK LAPJA in Hungarian Vol 36 No 7, 1981 pp 370-374
manuscript received 24 Mar 80

MARTON, GYULA; Mrs. DENCS, BELA; SZOKONYA, LASZLO; and DUALSZKY, SANDOR, Kobanya Pharmaceuticals Works, Budapest

[Abstract] Laboratory tests were carried out to establish the equilibrium conditions between liquid and vapor in water/ethylene acetate mixtures. It was found that the relative volatility of the ethyl acetate is very high at concentrations of more than approximately 0.1 percent by weight. Condensation of the vapor yields a two-phase liquid system which separates according to the mutual solubilities. On the basis of the results of these tests, studies were carried out with batchwise and continuous disctillation systems to develop a suitable procedure for the removal of a solvent such as ethyl acetate from solvent-containing wastewaters. In neither test series did the usually encountered other contaminants interfere with the solvent removal. In the technological system, featuring continuous distillation, the solution is preheated (to about 333°K) and heated in the distillation system to about 373°K, at which temperature most of the ethyl acetate evaporates. The condensate is then phase-separated. The solvent phase contains very little water. The aqueous phase is fed back to the inlet. The distillation column is designed in such a manner that the residual solvent can be fully recovered. An experimental system was operated to obtain experience with its performance under plant conditions. It was confirmed that the system is efficient, technologically feasible, and economical. Preliminary tests were carried out to evaluate the suitability of the method for other solvents such as 1,2-dichloroethane and methyl isobutyl ketone. Figures 5, tables 2, no references.

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STOCHASTIC ANALYSIS OF THE INTEGRATION OF ETHYLENE STORAGE FACILITIES

Budapest MAGYAR KEMIKUSOK LAPJA in Hungarian Vol 36 No 7, 1981 pp 346-348
manuscript received 4 Mar 80

MANHALTER, PETER; and TABOR, ISTVAN, Association of Computer-Technology Development in the Chemical Industry, Budapest

[Abstract] The optimization of ethylene reservoirs connected with a pipeline system was investigated. Use was made of the theory of Markovian chains for the formulation of the task in terms of a mass-service problem. The aim was the determination of the optimum tank-farm size and the economic advantages of constructing the pipeline connecting the individual tanks located at sites where the ethylene is produced and used. The storage system features buffer tanks into which ethylene is fed whenever the user facility obtains an excess and from which ethylene is withdrawn whenever the user facility shows a deficiency. The principle of "accumulated stock" was introduced for the processing of the status data coming from the various sensor locations. Operating data from ethylene production and utilization facilities were collected to establish the relationships required for the designing of the optimum system. For practical use, it is then necessary to know the total capacity of the tank farm and the magnitude of the starting stock. The results of the analysis were applied to a proposed facility. It was established that optimization by means of the method developed is feasible. The main procedure of the method involves the simulation of the temporal course of the ethylene balance. This is accomplished with the aid of a random-number generator and the Monte Carlo method, using the queue theory. The method does not unify the parameters for repair-time distribution nor for operating times. Nonetheless, the stochastic character of the processes involved justifies the approach employed. Figure 1, 2 Hungarian references.

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UDC: 665.7[665.668.1](439):658.628.011.1

DEVELOPMENT OF THE LIGHT-PRODUCT SYSTEM AT DANUBE PETROLEUM-INDUSTRY ENTERPRISE

Budapest MAGYAR KEMIKUSOK LAPJA in Hungarian Vol 36 No 7, 1981 pp 343-345
manuscript received 6 Mar 80

RATOSI, ERNO; PERGER, JOZSEF; and WAPPEL, LASZLO, Danube Petroleum-Industry Enterprise, Szazhalombatta

[Abstract] The enterprise is expected to process approximately seven million tons of petroleum per annum in the foreseeable future. About 55.7 percent of the production represents light products, defined as gasoline, light oil, gas oil, and products derived from these such as aromatic compounds and their derivatives. Among the light products, gasoline and liquefied gas accounts for 19.7 percent. It is considered that the percentage of aromatics could be increased, and that it would even be possible to increase the percentage of all light products. This would be desirable since especially the aromatics could be sold at higher profits, and marketed in capitalist areas. A plan was therefore developed for the implementation of an improved light-product system. The plan considers the required investments, sale possibilities, domestic needs, and staff resources. Emphasis is placed on the production of more jet-engine fuel and aromatic compounds, and on the introduction of new products. Only minor plant conversion would be required for increasing jet-fuel manufacture, and since the domestic demand for this fuel is expected to increase, the required investment would pay for itself soon, especially in view of the fact that increasing amounts of jet fuel are now imported. The amount of investment required for increasing the production of aromatic compounds is higher; however, it is considered that the increased capacity (especially the production of more xylene, n-hexane, and high-octane additives) is desirable. In order to increase the total light-product yield, it would be necessary to implement fluid catalytic cracking technology. Full implementation would increase the yield of light products to 68.1 percent of the total production. Figures 2, no references.

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UDC: 665.6/.7.013(439):658.628.011.1

EXPANSION OF THE PRODUCT LINE OF PETROCHEMICAL COMBINES

Budapest MAGYAR KEMIKUSOK LAPJA in Hungarian Vol 36 No 7, 1981 pp 339-342
manuscript received 24 Mar 80

KOVACS, ISTVAN, Borsod Chemical Combine, Kazinbarcika

[Abstract] During the 1960's, one of the two Hungarian chemical combines (Borsod Chemical Combine [BVK] and Tisza Chemical Combine [TVK]) started to specialize for the production of polyvinyl chloride and the other for polyethylene. BVK produced acetylene by the oxidation of natural gas, and TVK produced olefin products by gasoline pyrolysis. TVK started producing ethylene during 1975 in a new facility for the manufacture of polyethylene and for supplying the Soviet vinyl chloride plant in Kalus. The latter plant supplied polyethylene and other chemical products in exchange. TVK also uses part of the ethylene production for polypropylene manufacture. Both chemical combines are considering further expansion of their product lines. The following possibilities appear to be economically desirable for BVK: (1) Production of phosgene derivatives from the 50,000-60,000 tons of carbon monoxide that can be manufactured; (2) Production of nitrobenzene from the nitric acid excess and benzene (the nitrobenzene could be reduced with the hydrogen available to aniline); (3) Production of MDI [expansion unknown] from aniline and phosgen for polyurethane manufacture; (4) Production of aliphatic amines, diamines, and dimethylformamide from part of the carbon monoxide and ammonia excess; and (5) Producing intermediates for pesticide and pharmaceuticals manufacture from aromatic amines and isocyanates. These plans, when implemented, would produce materials that can be profitably exported, would utilize byproducts which are presently not used economically, would permit more efficient factory operations, and would make it possible to produce chemicals which are presently imported. Another important result of the planned expansions would be the fact that the investment-intensiveness of BVK's production could be decreased by a factor of 2.6. In addition, the annual profit would increase 4.9-fold with a staff increase of 13 percent. Implementation of the plans would require an increase in the fixed investments of the combine by 87 percent. Figures 2, table 1, no references.

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NITROGEN FIXATION IN A PROTONIC MEDIUM. BIOLOGICAL NITROGEN FIXATION AND ITS CHEMICAL ANALOGS

Budapest KEMIAI KOZLEMENYEK in Hungarian Vol 55 No 1-2, 13 Jul 81
pp 13-37 manuscript received 26 Oct 79

SILOV, A.E., Institute of Physical Chemistry, USSR Academy of Sciences, Chernogolovka, Moskovskaya Oblasti 142432, USSR

[Abstract] This article, the text of the author's paper delivered at a meeting of the Coordination Chemistry Group of the Hungarian Academy of Sciences, is an updated version of the relevant portion of the book entitled "Biological Aspects of Inorganic Chemistry," edited by D. Dolphin, published in 1977 by J. Wiley and Sons, New York. Theoretical considerations (possibility of the one-step multielectron reduction of nitrogen and intermediate products of the reduction of nitrogen in a protonic medium) and nitrogen-fixing systems in a protonic medium (nitrogen gas, reduction in the presence of trivalent titanium and molybdenum, and bivalent chromium and vanadium hydroxide; amalgams of the alkali metals as reducing agents; the electrochemical reduction of nitrogen; the vanadium and magnesium hydroxide systems; the complexes formed between bivalent vanadium and pyrocatechol or its related compounds; and other nitrogen-reduction systems in protonic media and the Schrauzer nitrogen-gas model) are discussed. In all known cases, the reaction takes place in the coordination sphere of the catalyst complex, without the intermediate formation of N_2H or N_2H_2, and in most cases of free hydrazine. Direct reduction to ammonia was also possible in some systems from nitrogen gas. Various conditions must coexist for successful reaction. For example, reduction of nitrogen may be expected in the complexes of d^3 and d^4 transitional metals, particularly trivalent molybdenum and bivalent vanadium. The oxidation-reduction potential of the reducing agent must be high, probably higher than of the $N_2 + 2e^- + 4H^+ \rightarrow N_2H_2$ system. Favorable catalyst complex systems are described and it is concluded that, in general, multinuclear systems are most favorable for the reduction of nitrogen. Figures 7, tables 3, references 75: 2 German, 38 Russian, and 35 Western.

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MATTERS CONCERNING PROTEIN SUPPLY; NEW PROTEIN SOURCES

Budapest KEMIAI KOZLEMENYEK in Hungarian Vol 55 No 1-2, 13 Jul 81, pp 163-177, manuscript received 17 Jan 80

LASZTITY, RADOMIR, Dr of chemical sciences, Department of Biochemistry and Food Technology, Budapest Technical University

[Abstract] In his lecture delivered at the Food-Protein Conference of the Hungarian Academy of Sciences, held in Balatonfured on 10 May 79, the author discussed the present status of the world protein supply, means for increasing the protein production from currently available sources, and the prospects of potential new protein sources. At the present time, approximately 70 percent of all protein produced is of vegetable origin and the rest of animal origin. It is possible to increase the production of protein from grains such as wheat, maize, and barley (but not of rye) two to three fold by the end of the century. Other major sources of vegetable protein are soybeans, other oilseeds, vegetables, and leaves. Appropriate improvements in growing, harvesting, storage, and processing could result in major increases in protein production from these. Unicellular protein sources (algae, yeasts, and certain bacteria) represent a relatively recent development. Once the toxicological and hygienic problems are resolved, they represent a major future protein source. The same applies to microbial protein types made on a methanol basis. It is expected that proteins of vegetable origin will continue to predominate in the next 10-15 years. However, over the long range, unicellular proteins are expected to play a major role. Initially they are likely to be used mostly for animal feeding, and in a next step by countries without adequate soybean and fishmeal resources. Cost factors, presently still uncertain, will play a major role in the development of these protein sources. In the very distant future, biochemical reactors in which nuclear or fusion power is used for creating proteins in a systematic manner may be developed. Figures 2, tables 11, references 12: 5 German, 3 Hungarian, and 4 Western.

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ELECTRONICS AND ELECTRICAL ENGINEERING HUNGARY

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SELF-TESTING OF HIGH-SPEED DIGITAL EQUIPMENT

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 10, 1981, pp 372-379
manuscript received 21 May 81

SZENCZI, ARPAD, and SZEPHEGYI, ATTILA, Department of Electronic Metrology, Research Institute of the Communications-Technological Industry, Budapest

[Abstract] The author discusses self-testing of high-speed digital equipment on the basis of functional tests (for example, in a general-purpose processor, the following functional groups may be used: data storage, data transfer, register selection, command decoding, execution of arithmetic or logical operations, and control functions) and describes the algoritmic signal-pattern generator (this high-speed unit generates the algorithmable patterns required for the testing of LSI memories, meaning the generation of the following signal categories: control of the memory tested, addressing the memory tested, supplying data to the memory tested, and readout of the data from the memory). Three application examples are presented: testing program for the control memory, testing data transfer combined with incrementation, and testing a subtraction. Although only limited means are available for the detection of faults in self-testing, the faults can be generally localized at a high degree of accuracy under real-life conditions. Self-testing will become increasingly important as the complexity and the number of components in systems increases. Development of hardware test programs -- which presently lags behind -- will significantly improve the effectiveness of the testing. Further studies are required, however, before such programs could be prepared. The trend is toward the development of special diagnostic systems which indicate simple faults, localize the faults, and in some cases correct the faults. Figures 6, tables 2, references 6: 1 Hungarian and 5 Western.

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DESIGNING PROM/EPROM MICROPROCESSOR PROGRAMMING DEVICES

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 10, 1981, pp 380-384
manuscript received 1 Jul 81

HAINZMAN, JANOS, Dr, and KOLLAR, ISTVAN, Department of Instrumentation and Metrology, Budapest Technical University

[Abstract] This article describes a suitable command set for programmers on the basis of the PROM program, developed at the authors' institute. It is assumed that the program operates under an operating system that performs memory listing and modification so that the programming software does not require these functions, and merely entry and departure from the program is needed, meaning that there is no need for listing the memory area, modifying the memory area, and connection to external computer or perforated tape reader. The commands include V (verify), R (read), C (combine), E (empty), T (test), W (write), J (jump), X (exit), Y (copy), S (signature, check sum), M (mask), I (invert), H (higher four bits), O (over four bits), and N (normal mode), plus optionally Q (read), Z (write), L (load), and P (patch). Means to eliminate operator errors are provided. The MMT system features the programming device supplementing the existing microprocessor with a periphery card performing special functions and attached modules. The developing device DT-80 forming part of the MMT system has a bus system of which the definition is the same as that of the user bus system, so that the PRO card can be either that of the developing system or that of the user. In the present version, all commands except copying, S, M, I, and N can be realized. The program, including the tables, is shorter than 4 kbyte. It can be presently used to write the following PROM/EPROM types or their equivalents: EPR modules, UPI modules, SPR modules, and TPR modules. References 11: 2 German, 3 Hungarian, 1 Russian, and 5 Western.

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ACOUSTIC EMISSION RESEARCH AT THE CENTRAL PHYSICS RESEARCH INSTITUTE OF THE HUNGARIAN ACADEMY OF SCIENCES

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 10, 1981, pp 392-395
manuscript received 13 May 81

PETER, ATTILA; PELLIONISZ, PETER; and GEREB, JANOS, Central Physics Research Institute, MTA [Hungarian Academy of Sciences]

[Abstract] Acoustic-emission measurements and acoustic-emission instrumentation carried out or developed at the authors' institute are described. Among the acoustic-emission measurements, those aimed at the determination of the fracture mechanism and stress corrosion of steels, and the fracture mechanism of rock samples deserve special mention. In the stress-corrosion measurements, the fork-shaped test sample is subjected to mechanical stress under thermal loading and exposure to corrosive agents. The fractures that develop and propagate generate acoustic emission signals which are continuously recorded. Measurements were also carried out with the sample under tensile testing. In the rock (primarily marble) samples, studies were also carried out with the aim of forecasting future fractures. The Kaiser effect (acoustic activation of a sample reoccurs only if the stress exceeds the maximum of earlier tests) was also investigated. The method was found useful for establishing whether the stress in a rock sample stabilizes after a period and for determining the maximum stress to which the sample had been subjected before. A four-channel acoustic-emission analyzer (NEZ 210) was developed. It detects the acoustic-emission events, counts the events, and totalizes the oscillation parameters for each channel. The results are displayed on seven-segment LED display, X-Y plotter, and digital character printer. The measuring and signal-conditioning units of the instrument are constructed in the internationally standardized NIM nuclear-instrument module system. A level accommodates four modules, connected via an NIM bus system made up of the standard computer data bus as well as additional digital and analog connections. Figures 5, references 11: 1 German, 2 Hungarian, and 8 Western.

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TESTING THE TYPE KFT 8080 MICROPROCESSOR WITH THE ICOMAT-110 MEASURING EQUIPMENT

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 10, 1981 pp 365-371
manuscript received 5 Jun 81

SIMON, ZOLTAN, Dr; SZENCZI, ARPAD; TARJAN, GYORGY; and TOMAN, GYORGY, Research Institute of the Communications-Technological Industry, Budapest

[Abstract] In the ICOMAT-110 measuring system, developed at the Research Institute of the Communications-Technological Industry, the test vector series for the diagnostic procedure (indicating faults as well as their causes) are derived in part from algorithm and in part from stored patterns. It has an algorithm signal-pattern generator with a high-speed data-buffer memory. The system consists of a specially designed, multiprogrammed, high-speed processor that generates the algorithmic pattern, and of an equally high-speed data-buffer memory. The circuit to be tested is adapted to the signal-pattern generator via a type card. The assembly, consisting of the ICOMAT-110, the type card, and the wafer-measuring unit, is capable of testing the operation of the microprocessor under the least favorable supply, drive, and timing conditions. Generation of the input and output pattern, changing the timing, and selecting of the tested outputs is accomplished by means of the ICOMAT-110 control program. The following program modules are available: PC test, ALU interference-resistance measurement, internal bus test, test of ALU + combinatory logic, switching-adding-subtracting unit test, and internal memory test. Measurements were made with the above hardware and software on microprocessors from current production. The results indicated that faults could be diagnosed and their causes determined. Figures 7, references 10: 6 Hungarian and 4 Western.

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CSO: 2502

LINKAGE OF SCIENCE AND INDUSTRY PROPOSED

Warsaw TRYBUNA LUDU in Polish 2 Dec 81 p 3

[Article by Tomasz Miecik: "How to Link Science With Industry. Proposals of the Gliwice Community"]

[Text] Within the scientific community and society at large there prevails a profound belief according to which the areas of science and technology should undergo change. The scientific community itself has, of course, the most to say on this topic, and drafts for the most appropriate solutions can evolve within it.

It is notable that many proposals for changes in the scientific-technical support base originate within the party's organizational units or in party teams operating in the scientific community. We have presented many such drafts, including those developed by the party organization of the Polish Academy of Science and the Main School For Planning and Statistics. Aside from issues specific to this community, these documents, let us note, focussed on the role and function of science in society and the development of safeguards to prevent retreat to an instrumental approach to science.

Studies are currently underway to determine the position of the scientific technical support base within a reformed economy and linkages of future developmental mechanisms with technological progress. Among these studies, a particular position is occupied by the proposals drafted by the Gliwice scientific and technological community, one of Poland's major clusters of industrial institutes, design offices, colleges and PAN institutes with considerable expertise in scientific and industrial cooperation. This subject is being discussed for the most part in the forum of the party's Commission For Affairs of Ministerial institutes. The commission is consultative and advisory in character and its mission is to bring about effective utilization of the potential concentrated within the industrial and agricultural scientific-technical support base under a reformed economic system.

One of the earliest studies of this team is a detailed organizational analysis of what is termed a scientific-productional complex and the principles under which work is coordinated in research centers. The authors' point of departure is that science, technology and production practices constitute an inseparable whole. Accordingly, prior to issuing legal directives and normative standards for the particular segments of the scientific-productional complex, a coherent view must

be determined for the functioning of this complex in its entirety. What the authors label the scientific-productional complex are enterprises and institutions that collaborate on the processing and utilization of scientific knowledge.

Included in the complex are universities which, according to the draft, should become responsible for training engineers and a scientific research force. These include PAN centers that conduct basic and developmental research which create an indispensable reservoir of theories and scientific concepts for possible use in technological advances, (ministerial) industrial research institutes responsible for technology levels in specified areas of economic activity, design offices which ensure quality control solutions for investment preparation, technical and structural design service branches and subunits for technological progress within those plants charged with application of modern technology; research and development centers responsible for up-to-date products especially in those industrial branches that require a rapid response to changing trends; factory research labs primarily charged with the supervision and direction course of complex technological processes; units handling technological, scientific and economic information to develop problem-targeted technical and economic analyses and organizational expert assessments and patent studies.

Efficient operation of this complex requires integration of all of its components. For this purpose, individual institutions assign portions of their total potential for work jointly with those components with which they are collaborating. For example, certain higher educational establishments conduct some work in industry, industrial research institutes can create small design units and conduct fundamental research within certain limits, design offices can operate systems for scientific, technical and economic information and can perform project studies and forecasting work. This solution introduces an element of competition, favorably affecting the quality and effectiveness of work.

The importance of technological and economic progress to restore the country's potential, the advantages of specialization and co-production along with the intensifying signs of conflicts of interests are believed by the authors' of the study to require the establishment of a strong center for coordination of scientific-technical activity in the country. At the same time, this center must be organized so as to preclude the danger of arbitrary styles in the management of the science-production complex. This type of center received the name of KPNT [Committee For Scientific and Technological Progress] and principles for its operation were developed.

The tasks of the management center would include, among other things, the generation, implementation and coordination of actions for the sake of scientific-technological progress in the production sector and in health care, allocation of budgetary resources earmarked in central programs for research and development and application. The committee would periodically submit to the Sejm of People's Poland all data needed for realistic planning to satisfy the nation's material goods and health protection needs. The parliament, in turn, would transmit to the center the standards for compromise and priorities to be applied in the planning and would appropriate resources to implement central programs. The KNPT tasks would also include the protection of national interests involved in scientific-technological progress (protecting creative persons, natural environment, domestic technological concepts, and industrial property, among other things).

The foremost duty for KNPT would be to analyze the domestic state of engineering techniques and technology in comparison with world achievements and to transmit its conclusions to the government. Analyses and reports on the condition of the national economy in regard to utilization of technological progress would form input in the development of socioeconomic plans for the country. The government, in turn, would supply the committee with data on external conditionings of the operation of the science-production complex, such as financial possibilities, foreign trade outlook and the state of national and world economy.

On this basis, the committee would undertake incentive and coordinating actions. It is envisaged that the management center would have the right to exercise its own initiative to form new research units and delimit their scope of operation, conduct personnel policies in scientific technical facilities, along with the right of legislative initiative in the entire sphere of scientific-technological progress. The committee would also format a system for financing research and technical work and application.

Through their scientific councils, the institutes would transmit to the center their offers to do projects which failed to secure direct orders from the industrial sector. The center would then balance the needs with financial possibilities and would contract with institutes to perform selected projects, allotting, at the same time, resources from the central budget for their completion.

In keeping with the concept discussed here, the committee would base its operation on collective, interdisciplinary, and specialized knowledge of a fairly large group of experts selected by particular components of the science-production complex. In order to avoid arbitrary decisions, the authors of this concept propose that the KNPT be composed of a State Council For Scientific-Technological Progress, appointed by the chairman of the council of ministers, and a Self-governing Council of the Scientific-Technological Support Base--an autonomous body operating on the strength of a separate charter.

These, in capsule form, are the proposals of the Gliwice scientific community presented more extensively in TRYBUNA ROBOTNICZA of 10 November 1981. As mentioned earlier, other proposals of this kind are evolving in the scientific community's party organizations operating there. We will present them, recognizing the fact that they are geared toward the implementation of the resolution of the Ninth PZPR Congress requiring party organizations to "constructively transform higher education and scientific communities, bring down the barriers between sections of science, and integrate science and scholars around jointly determined cognitive and social goals."

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EAST EUROPE REPORT
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STUDIES OF NUCLEAR PHYSICS INSTITUTE AID ECONOMY

Tirana ZERI I POPULLIT in Albanian 19 Dec 81 p 3

["Studies Which Help To Increase Production and To Improve Its Quality"]

[Excerpts] The scientific-research activity of the Institute of Nuclear Physics, guided by the teachings of Comrade Enver, its director Skender Koja told us, has been developed in directions which are of special interest to our economy and our life.

Among the many projects completed in 1981, the following are worthy of note: the study which has been made in connection with the soil in Lushnje (in Krutje), a study which is included in the multi-year theme "Nuclear methods in the solution of problems related to the rational use of fertilizers." The recommendations made in this study will be forwarded to the appropriate department for execution. The application of the recommendations will result in a considerable saving in phosphate fertilizers for the agricultural units.

In its scientific research activity, the institute is also concerned with the designing and construction of a prototype of automatic control apparatuses for industrial needs. This year, a number of industrial items which are very much needed by our light industry have been constructed and put into use this year. Also, the construction of meters at the fluid level in various reservoirs has been of special interest for industry. Seeing the effectiveness of this apparatus, the institute has received requests from various sectors of production to direct the series production of such apparatuses by our electronics industry. This year, preparations have been made to put into operation, in the future, a device for the continuing automatic measurement of the density of the rinsing solution in oil wells.

In light of the importance of geochemical methods in prospecting for and discovering petroleum and other ores, the collective of the institute is using two modern methods of analysis more successfully--neutron activation and fluorescent X-ray. In order to take care of the large number of analyses which are required by the basic units (thousands of such analyses are carried out in the institute) a service group, composed of physicists, laboratory workers and skilled technicians who make analyses for the petroleum and geology sector, has been set up. These people give exact determinations of the presence of traces of elements in small quantities in the soil, and the location of layers of oil-bearing ores or

other ores. The advantages of these methods, compared to earlier methods are, first of all, the speed of the analyses and their accuracy and the identification of some elements which other methods do not discover.

During the past year there have been other studies of great interest to the economy such as the studies aiming at the extending of the period which some agricultural crops, especially potatoes and onions, can be kept and the stimulation of seeds to increase productivity without supplementary investments.

It is important to stress that the results achieved here over many years conform to those achieved by scientific research institutions in other countries. Therefore it is time for the studies concluded in these fields to be accepted immediately and without hesitation by the ministries concerned and put into practice.

A very important aspect of the activity of this institute for this year is the study of the production of radiated polyethylene, which has new insulating properties in the most difficult situations of corrosion and humidity. On the basis of such a study, polyethylene has been produced for some large electrical units of the "V. I. Lenin" hydroelectric power plant, the metallurgical plant and other factories. The communications sector has also requested this product.

Additional elements in ore samples will be identified in 1982. Also, the assistance which the institute gives to the petroleum sector will be expanded, both in the field of research and in the field of rational utilization of wells.

CSO: 2102/4

CSSR'S SHARE IN INTERKOSMOS SPACE COMMUNICATIONS PROGRAM

Prague TELEKOMUNIKACE in Czech No 10, Oct 81 pp 147-148

[Article by Svetozar Durovic, Communications Research Institute, Prague]

[Text] The wideranging scientific and technological development program known by the acronym INTERKOSMOS is subdivided into five subject areas--space physics, space meteorology, space communications, space biology and medicine, and remote-sensing earth sciences research. The Ministry of Communications has jurisdiction over problems associated with space communications.

The Standing Task Force for Space Communications, which is in charge of directing programs of common concern, has identified some primary areas of interest (subject areas is the usual term of reference) and subdivided them into eight research topics:

IK 1 -- The development of new frequency wave bands, research into the design of space satellite communication systems operating in the 10-30 GHz wave bands;

IK 2 -- Research into optimal methods for the transmission of signals in satellite networks in conjunction with the application of advanced technologies;

IK 3 -- Research into the principles of interacting satellite and ground-based communications systems;

IK 4 -- Monitoring issues affecting the development and optimilization of the construction of ground station systems for satellite communications;

IK 5 -- Research into the principles of the effective application of geostationary orbits and shared frequencies of satellite and ground-based systems;

IK 6 -- Research into Satellite television transmission systems operating in the 12 GHz wave band and planning for their introduction into service on an experimental basis;

IK 7 -- Research into multilateral access methods;

IK 8 -- Uncooled low-noise parametric amplifiers operating in the 3.7-4.2 GHz wave bands.

Czechoslovakia is making a contribution to solving problems in virtually all of these research topic areas, but it is devoting special attention to the tasks mandated under the terms if IK programs 1, 2, 5, 6, and 7.

At the present time the IK-1 research topic is being pursued as a part of work on the construction of the international experimental testing center in Dubna (USSR). The focus of attention there is on the installation of equipment, and individual member countries will have an opportunity to carry on appropriate scientific-technological research programs. Special signals will be sent out from this research center to satellites which in turn will make it possible to bounce these signals back to the national testing centers of the member countries.

The design of the experimental satellite system operating in the 11-14 GHz wave band was coordinated by the GDR, and this design in turn served as the source of the standards that were applied in the development and production of the essential systems that were used to equip the testing centers. The main contributors to the development of this technology are the USSR (first-generation receivers and transmitters and second-generation transmitters), the GDR (computer hardware for the testing centers used to evaluate the experimental signals and to further enhance them), and the CSSR (second-generation receivers and radiometers for the 12 GHz wave band). Other countries played a part in this experiment by contributing auxiliary systems such as rain gauges, registers, and so on.

The birth of the first Czechoslovak receivers for the 12 GHz wave band was not an easy one. In connection with the design of the experimental IK-1 system the CSSR was charged with coming up with a design for a fully equipped second-generation set, i.e., a transmitter and a receiver equipped with a small antenna with a diameter of 3-4 meters, a power output rating of 250 watts, and a receiver quality rating of 20 dB/K. This system was designed for the duplex transmission of smaller-scale digitalized telephone signals, wide band television reception, and the reception and evaluation of signals for purposes of signal propagation research. Unfortunately, the Czechoslovak electronics industry was not able to meet demands for the development and manufacture of a complete set, in particular for reasons having to do with problems connected with the output travelling-wave tube for the 14-GHz wave band. Consequently, there was nothing left to do but scale down the demands that were originally levied upon the industry and focus solely on the development of the receiver portion of the system. On the basis of technical specifications worked out in conformity with a system design produced by the Communications Research Institute the Communications Technology Research Institute, working together with the Radio and Electronics Engineering Institute of the Czechoslovak Academy of Sciences (which designed a local oscillator set with an extremely high frequency stability rating), developed a second-generation receiver and delivered the finished product to the contracting agency. In many important respects performance standards were achieved that surpassed those required under the terms of the original order.

Staff members of the Communications Research Institute put together a radioelectrical part for a new standardized housing which rendered the receiver unit transportable with much more room for working parts and a much enhanced capability for resisting atmospheric influences. The set was supplemented by the addition of a limited high-gain antenna system which further enhances the usefulness of the

entire component. The system was then subjected to exhaustive tests and checked out under long-term operational conditions. In May 1981 it was sent to an international testing center in the USSR. Here too it gave a good account of its performance standards and, with this successful design record to its credit, it was well received among Interkosmos users.

However, the CSSR was not yet completely finished with its work on the research and development of a second-generation duplex set. After lengthy negotiations between the Communications Research Institute and the Communications Technology Research Institute success was finally achieved in coming up with a design for the second component of this set which makes it possible to link up the receiver with a transmitter that was developed elsewhere. In addition to this capability, the set has a bigger antenna with a diameter of 4 meters that can operate throughout the entire spectrum of from 11 to 14 GHz.

Work is proceeding at the same time on the construction of our own national testing center. This construction work is now under way at the site of the Sedlec radiocommunications center which, in spite of its rather modest endowment of equipment, has everything that is needed for this kind of experimental program. In addition to space communications sytems, work is also moving ahead here on the installation of sections of ground lines for research into the propagation of frequencies in excess of 10 GHz as well as on the installation of radiometric monitoring systems.

The CSSR has been very actively involved in working on research problems mandated under the terms of the IK-2 program, and this is a consequence of the unprecedented interest that exists in this country in new modulation methods for transmission purposes. Three outside laboratories have applied to participate in this research program.

The Electrical Engineering Faculty of CVUT [expansion unknown] is working on research into digital television transmissions via satellite communications networks. It goes without saying that the overall problem of digital television cannot be addressed by any one research project. This project is devoted only to working out some of the problems at hand, namely, research into adaptive delta modulation combined with composite coding and, further, time multiplex digital television combined with other data signals, something which would open the way for a larger scale transmission system for subscribers to satellite communications traffic. Inasmuch as the designers want to exploit the 27 MHz wave band for the transmission of an integrated signal, this suggests that this capability will be applied some day within the framework of a system used for the direct broadcast of television and radio programs via satellite.

The Radio and Electronic Engineering Institute of the Czechoslovak Academy of Sciences is conducting work in the area of digital phased modulation and it has produced a model capable of a transmission rate of 20 Mbit/second. The receiver employs coherent detection, whereby the regeneration of the coherent carrier is assured by means of remodulation and filtration through a phased carrier and the timing frequency is derived by means of a crystal filter.

At the Tesla Communications Technology Research Institute work has been successfully completed on the development of a system for the transmission of multiple

audio signals which are integrated into a television carrier signal. This principle consists of the application of PCM [pulse coded modulation] to audio signals and also in the time-multiplexing of digitalized audio signals over a television transmission path. Over the course of prolonged tests conducted in the CSSR using ground and satellite communications networks it has been demonstrated that the transmitted signals are of high quality (according to one option two discrete radio channels can be transmitted over a television signal with a "Q" quality rating) and that the system has a significant performance capacity rating. The virtue of this performance rating consists in particular in the fact that it is possible by a simple selection process to change operating transmission modes and, wherever necessary, to transmit up to eight commentator signals with a "B" quality rating. This is a very effective tool that can be used by both programming employees and communications technicians, since it is now possible to choose an operating mode option that best fits the requirements of the situation at hand. The principles according to which this system was developed have a number of other applications (the transmission of several audio signals in a television broadcast, high-quality sound in systems employing the direct propagation of television signals via satellite, and many others).

The CSSR has already submitted reports to INTERKOSMOS experts on the results of these tests. This system has also attracted a great deal of interest due to the fact that within the context of the programs of international scientific experiments that are being conducted under the terms of the IK-2 project this system will be tested both in the conventional 4/6 GHz wave bands of satellite communications systems and in the new 11/14 GHz wave bands at the international testing center in the USSR.

The CSSR is coordinating the IK-5 research program. Our principal contribution to this program consists in the development of frequency planning methods using computers. This is an entirely new discipline, which, in addition to figuring out the radio-electrical principles of systems compatability, must also solve problems related to the integration of this system with computer technology, including data classification, the efficient utilization of this data, and so on.

The first experimental groundwork for this new perspective on this problem was the frequency plan for a satellite broadcast service operating in the 12 GHz wave band that was worked out as part of preparations for the WARC-BS-12 GHz World Conference. A joint coordinating process, in which the CSSR and the USSR were the main contributors, resulted in the formulation of a draft plan that was adopted by government organizations of the socialist countries as the basis for the positions presented by our countries at this conference held in 1977. This plan made it possible to conduct working spotchecks while the conference was in progress and contributed to the successful outcome of the negotiations, meaning that all of the demands advanced by the socialist countries with respect to frequencies and orbital positions for a satellite broadcasting service were accepted.

Based on the experience that was gained in connection with the application of these interdisciplinary approaches, planning methods are now being worked out that are applicable not only to putting entirely new systems into service, but also to the modification of wave bands already in service in support of the fast growing

network of ground-based and satellite systems. This is an exceptionally important task, since adaptive methods are capable of respecting existing systems, without hampering the development of new systems.

The IK-6 research program has now become a topic of prime concern. The fully loaded frequency wave bands of the ground-based television transmission system make it impossible for us to introduce even a third television program channel in this country that would have nationwide coverage. The satellite broadcasting service systems that are slated to go into operation in neighboring western countries are a sufficiently important challenge to engage in competition in this field as well. And, finally, it is necessary to take into account worldwide trends which indicate that television transmission wave bands at the lower end of the frequency spectrum are being opened up for the use of mobile services.

The whole problem area of line-of-sight electromagnetic wave propagation is subdivided into a systems component and a frequency plan component. As a part of a jointly coordinated effort on the part of the countries concerned plans are being made for standardized systems and transmission parameters for a new service. These parameters will then lay the groundwork for the development of the engineering specifications that will be applied to the system's ground-based and space-based sectors. At an international scientific symposium held in Warsaw in 1980 the CSSR presented its contribution toward solving this problem. A study that is to be made of the positions presented by the respective countries concerned is supposed to culminate in a plan for an international experimental satellite broadcast service system which would enable the member countries to use their shared television satellites to test the system's engineering and technological features. The CSSR has announced that it is ready to participate in this cooperative venture, and, in view of the timeliness of this service as far as our own country's needs are concerned, is devoting increased attention to this program.

The CSSR is working on the IK-7 research program by way of the MODIKA computer simulation program--a model of a digital channel which is paving the way for the introduction of digital transmissions via satellite channels. This simulation project involves the modeling of all of the important components of the transmission path (receiving and transmission filters, nonlinear elements in the transmission path, and so on) as well as other factors having an impact on the system (Gaussian noise, interference). This program makes it possible to set up for almost any modulation method of signal degradation. This channel model was developed by the Communications Research Institute with respect to the frequency aspects of the problem and by the Radio and Electronic Engineering Institute of the Czechoslovak Academy of Sciences with respect to problems having to do with the time representation of signals. Both institutions, however, are providing full range of information concerning the transmission of a digital signal via a ground-based or satellite-based channel.

Czechoslovakia is making a contribution to almost all of the space communications research projects covered by the INTERKOSMOS programs. It is a noteworthy fact that Czechoslovak industry is playing a role in the fulfillment of some exacting job orders. This is going a long way toward enhancing the value of our contribution to this common task, since this opens the way for the follow-on production of actual systems, first for experimental purposes and later on for normal operational purposes. By virtue of its combined scientific, research, and development contributions to INTERKOSMOS programs the CSSR is furnishing documentary proof of the importance which it attaches to joint ventures.

11813
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LONG-TERM GOALS OF ELECTRICAL INDUSTRY OUTLINED

Prague JEMNA MECHANIKA A OPTIKA in Czech No 10, Oct 81 pp 257-259

[Text] In the preceding article dealing with long-term development of the machine industry we pointed out principles that the machine industry as a whole, and essentially also its microstructure, must use as a guide in its long-term development. Now we should examine what specifically ought to be the structure and microstructure in which the entire machine industry should develop. We start out with the premise that we and, understandably, not only we, singled out the utterly inadequate development of the electrical and, particularly, electronic industry and, within the latter, a considerable lag in a modern parts base, as the basic imbalance in the macrostructure of the entire machine industry. For that reason we shall deal in this article with the possibilities for potential elimination, or at least considerable alleviation, of this lag.

Innovations in electrical engineering and, particularly, in electronics are one of the decisive trends in scientific and technical revolution. They affect in an extraordinary way the national economy, the country's defensive capabilities, all scientific disciplines, medicine, culture, standard of living and the life style of a citizen.

Products of the electrical industry, particularly in the area of electronics and microelectronics, by themselves, or as components of products of other sectors, increase the social productivity of labor and add a new dimension of quality to mental work. They call for new professions, change the style of work, increase demands on theoretical knowledge. At the same time, they eliminate some formerly indispensable jobs. According to some prognoses, the absolute reduction in the number of workers in traditional occupations due to automation and computer technology should reach 50 percent by the year 1990, which will call for basic changes in the structure of professions. Under conditions of a capitalistic society such changes causes unemployment and intensification of class conflicts while, on the other hand, under conditions of a socialist society, they effectively promote implementation of the political objectives of socialism.

Decisions regarding the concept of further development of electrical engineering branches will have to respect their specific characteristics:

--they are existentially connected with the development of scientific disciplines--physics, chemistry and others;
--their innovation cycle is becoming increasingly shorter (e.g., in the case of microprocessors it is now 3 to 5 years), which calls for a much faster rate of

substitution of technological equipment than is the case in traditional mechanical engineering branches;
--the branch of electronics in general and that of microelectronics in particular poses little demand on conventional materials, energy and transportation, but requires smaller amounts of special and precious materials and semifinished products;
--the level of electronics, automation and computer technology has a decisive effect on the effectiveness of weapons systems and growth of the combat capability of contemporary armies and, in consequence, development of specialized electronics receives extraordinary attention of governments, with an embargo imposed on a number of sophisticated products and systems;
--electronics on world markets is characterized by high prices per kilogram of substance;
--the utility value of its products is increasing fast, even with the current decreases in production costs and prices, which are particularly pronounced in microelectronics;
--effectiveness of electrotechnical products from the viewpoint of the national economy must be assessed comprehensively--to include all generated savings and increases in prices per kilogram of final products and systems, as well as all savings accruing to their users.

There is a close relation between electronic consumption and the economic level of countries. For example, in the countries of Western Europe consumption of electronics represents approximately 2 to 2.5 percent of the gross national product. A rough comparison indicates that consumption of electronics in the CSSR is still only about half of what would be commensurate to the level of its national economy.

Yet, it cannot be claimed that we did not pay full attention to this sector of the machining industry until now. Already in the 3d, 4th and 5-year plans priority was given to the development of new branches of electronics and semiconductor technology. A number of accomplishments were achieved in comprehensive mechanization and automation, proficiency was gained in production of machine tools with modern controls, to include automated processing lines, of electron microscopes, television sets, etc.

In the Fifth Five-Year Plan development of light current engineering formed a part of the so-called developmental support program envisioning a triple increase of production in the course of 5 years. The directive for the Sixth Five-Year Plan also very specifically pointed out the need for priority development of the electronic industry and stipulated:

--continued development of light-current and electronic systems and implementation of expedient development of a parts base for electronics with priority given to microelectronic circuits with a high degree of integration and striving to attain a high technical level of machinery by stepping up...miniaturization of electronics;
--in the area of complementary products provide for development and production of measurement, regulation and control equipment, cables...;
--increase the share of automated machinery sets and lines and in production step up the share of numerically controlled machinery;

--orientate natural, technical and economic sciences on... development of electronics, automation and optimization of process control in complex, primarily technological systems.

These are without a doubt proper directives and their implementation also was not bad. On the basis of original development and by means of licensing arrangements came the development and, as of 1980, introduction into production, of new series of microelectronic components, i.e., numerical and analog integrated circuits with a high degree of integration. On the basis of international cooperation came the development of new systems of computers, computer EC 1025 for mass data processing and minicomputers SM 3-20 and SM 4-20 for control of production processes, together with their peripheral equipment, i.e., printers, memories, etc and software. Production started on new drive units for MEZOMATIC feed mechanisms which facilitate numerical control of machine tools and replace gearboxes with labor-intensive gearing. Basic research solved a number of tasks to meet the needs of electronics and microelectronics, such as development of an electron lithograph which facilitates exposure of submicronic structures, i.e., up to a million elements in a single integrated circuit, research of optical communications, etc.

Thus, the problem is not constituted essentially by any failure to comply with directives but, rather, by underestimating the growth of demand and a complete misinterpretation of the position occupied by the electronic industry in the overall system of the national economy. After all, innovations in electrotechnical engineering, and particularly in electronics, are one of the decisive trends in technoscientific revolution. They are of strategic importance to the national economy and are an integral part of policy of governments. In one of the previous articles we pointed out the amount of attention devoted to this field by the Japanese government which considers it to be the basic strategic element in the development of the national economy as a whole.

We too must draw appropriate conclusions from these facts. And that was actually done. The 16th CPCZ Congress adopted the following resolution in regards to this problem:

The problem of prime importance is development of electronics and microelectronics. We envision establishing their lead ahead of other mechanical engineering sectors, because we are aware of the fact that systematic electronization and automation applied to key sectors brings about considerable improvements in social productivity of labor, reduced consumption of raw materials, fuels and energy. To that end, in the coming years we must gain mastery in the production of integrated circuits for microprocessor technology, particularly memories, processors, test circuits, optoelectronic communication systems and investment electronics.

In the current period we are preparing a long-term program for development of electronics which is to encompass solutions to basic problems of this field in research, in international cooperation, particularly with socialist countries and the USSR, intensification of production capacities, as well as a program for introduction of electronics into individual sectors of the national economy. This line applies to the Seventh and Eighth Five-Year Plans. Contrary to other branches of mechanical engineering, the long-term outlook in electrical industry

will be dealt with specifically for shorter terms than the year 2000. The reason for this is the fact that substitutions in products assortment in this industry and innovation cycles are so short that a specific outlook to the year 2000 would be very inaccurate if not downright impossible. After all, who could have envisioned in 1960 that in 1980 application of microprocessors would occur at an industrial scale, that there would already be robots of the second and third generation in operation, that first transmissions would be made by means of opto-electronic communication systems, that videotelephones and videorecorders would be routinely used worldwide and that television sets would become household movie houses of a sort, with random selection of programs, a means of individual entertainment and source of information, etc. The rate of innovations of this type can and probably will be even faster and more surprising in the next 20 years than it was in the past 20 years.

If we take a closer look at the distribution of electric industry production, we find that almost 50 percent is supplied by this industry in the form of complementary products for final machine production, approximately one-tenth accrues to deliveries for investment, approximately 15 percent go for exports and only about 6 percent go to meet retail demands. A significant item in deliveries for investment is formed by metrological, automation and computer technology.

Deliveries for consumer goods inventories in the Seventh Five-Year Plan will be increased 37 percent (in retail prices) in comparison to the Sixth Five-Year Plan. The plan includes a significant increase in the production of color TV sets with the most modern screen produced under license, there will also be increases, e.g. in deliveries of tape recorders, record players and radio receivers, wherein already at the present the CSSR has an exceptionally high rate of availability in households. With increased deliveries of products for long-term personal consumption, it is envisioned to improve their technical level, attractive design, improved operational reliability and relative decreases in power input.

The plan calls for increased rates of exports to socialist countries. Substantial increases are planned, particularly for products of heavy-current engineering, metrology, control and medical instrumentation. The volume of exports to nonsocialist countries will be constituted primarily by deliveries of heavy-current engineering systems including assemblies, electric motors, metrological and control systems as well as color picture tubes produced under license. It is expected that exportation of medical instrumentation, which has been a very effective export item, will continue.

In comparison to direct exports, indirect exports have been substantially higher as part of exportation of complete industrial plants, complex systems and machinery products.

Let us point up some specific examples in regards to innovations in electronic production in the next period. Investment electronics constitutes roughly one-tenth of electronic production volume. A new series of television transmitters for the fourth television band (for the second television program) uses transistors for its future stages and for its output stages it uses also modern elements, the so-called clystrons of Czechoslovak production. A follow up to the transmitters is a transistorized series of television converters for the fourth and fifth TV bands designed for color transmission. For deliveries to the USSR was

completed a new type of ZONA 2 television transmitter with transistors, switching semiconductor circuits and Czechoslovak power tubes. Further expansion of color television in the CSSR will be pr moted also by gaining proficiency in the production of equipment for studio use, to include new Czechoslovak movie cameras that already constitute the equipment of some studia.

A contribution to expanding the extent of long-distance transmission and telephone paths will be made by a new radio relay system for 300 channels with a frequency-division telephone multiplex and a modern radio relay system with 30 telephone circuits with pulse-code modulation. This innovative step is characterized by full transistorization and a high degree of automated operation. Development of the sector of telecommunications will also be enhanced by the results obtained in development of the second generation of telephone exchanges with crossbar switches and predominantly relay control.

Of key importance is the sector of computer technology where personnel engaged in development completed a number of tasks relevant primarily to utilization of integrated circuits. This involves a set of basic and peripheral units for RPP 16 Standard and Mini control computers and JRP 12 minicomputers as well as completed development of an integrated version of a computer for mass processing of data, the TESLA 300, also with additional peripheral equipment (magnetic tape memory, control units, etc). Development of electronic calculators focused on types with integrated circuits of high density.

In the area of numerical control of machine tools, a number of control systems of the third generation was implemented. Developmental efforts were concentrated on design of control elements for electric servodrives, systems controlled by minicomputer, adaptive systems and units for high-precision position measurement. Potential applications of numerical control point also toward the area of automatic handling equipment, robots, and others.

To provide a wider view of innovative efforts in the sectors of investment electronics it would be possible to also mention sets of systems for data transmission, a system of radio stations with random selection of subscriber in the radiotelephone network, radar equipment, instrumentation from the area of measurement of electric parameters and spectrometers of nuclear magnetic resonance as well as instruments for measurement and detection of nuclear radiation, etc.

Deserving of attention is also the relatively young sector of electronics for medicine. This involves primarily instruments for diagnostics, monitoring sets and instruments for stimulating the function of human organs (such as a series of radiostimulators).

Another group of products is constituted by consumer electronics the assortment and innovation of which are in keeping with the development of technology and services. For example, in the area of sound reproduction the new technology must interface with the shift from mono to stereo and, in the near future, with quadraphonic reproduction. Similarly, in the case of television, from black-and-white image to color and ultimately stereo television. Thus, a new trend for innovation is also other instrumentation for recording and reproduction of quadraphonic signals and in the stage of developmental studies is instrumentation for recording of images, primarily videorecorders and magnetoscopes.

The common technical characteristics of contemporary radio receivers are fully transistorized design, gradual introduction of integrated circuits, concentration of selectivity, electronic tuning and sensor control in case of the more demanding types.

The production program for television receivers went in 1975 through a basic innovation stage formed by a switch to the modular concept of the chassis of black-and-white and color television receivers. This step is to facilitate a technically and economically gradual shift from hybrid types of receivers to an entirely semiconductor base. This concept will at the same time improve the technological process of production, particularly by facilitating optimum utilization of testing and control systems for automation purposes.

An adapter for replay of quadraphonic records is also ready this year for stereo record player chassis 130 and 140. At the same time provisions are being made for production of quadraphonic record players with a four-channel amplifier.

The stage of monophonic types in the area of reel-type tape recorders is coming to a close. For the coming period the B 73 stereophonic four-track tape recorder with three heads is ready and the B 83 new hi-fi tape recorder is envisioned for the future. In providing cassette-type tape recorders, attention is concentrated on international cooperation with the Hungarian People's Republic, the first result of which is, for example, a combination of a stereo record player, an amplifier and a stereophonic tape recorder.

The plan for technological development must play its role in improving the level of innovations, so as to promote the effects of technical and economic tools on a more expedient implementation of scientific and technical advances in practice. It is obvious that the extent of sectors of electronics that pervade all areas of social life cannot be provided solely by domestic capacities. For that reason a widely based division of labor has been organized in a number of sectors, particularly within the framework of CEMA, so that coordinated production programs of socialist countries would supplement the market byproducts and goods according to the comprehensive needs of users. In addition to providing investment electronic products for industrial sectors, attention will have to be paid also to the growing demand for electronic consumer goods, their higher quality, technical parameters, the level of utilitarian properties and esthetic appearance.

In supporting exports and deepening the international division of labor it will be necessary to overcome some limitations that are specifically characteristic of the branch of electrotechnical engineering:

--products of certain sectors place high demands on materials in short supply (nonferrous and precious metals, plastics, special materials). These include, e.g., transformers, electric motors, cables, batteries, etc. Therefore we see in individual socialist countries the manifestation of tendencies against exporting such products, or at least an effort to balance exports and imports, because it is these products that are in short supply in those countries as well;
--in the case of consumer electronics and electrotechnical engineering some products gradually saturate the domestic market by a traditional assortment of products and the individual country decidedly prefer their own production to imports.

In the subsequent period it will become necessary to rely on results of technological development which will constitute the production of the future.

This development will be oriented toward:

--implementing the technology of integrated circuits of high complexity;
--designing complex unipolar circuits for a 16-bit microcomputer system;
--developing optoelectronic elements and bubble memories;
--developing an electronic lithograph;
--developing processing methods using ultrasound, electroerosion, laser;
--electron microscopy and spectrometry;
--developing instrumentation for gas and liquid chromatography and pulse electrochemistry;
--new types of scintillation and gas detectors;
--new radiolocation systems;
--radio and television transmitters, radio stations and radio networks;
--developing communication systems with light-guidance cables;
--completing EC 1027 systems, problem-oriented peripheral subsystems;
--large-capacity disk memory;
--a system for automated design;
--developing cassette and elastic disks;
--a new microcomputer system;
--application of microelectronics and microprocessor technology;
--special servomotors, stepping motors;
--color television sets with "inline" picture tubes;
--stereophonic cassette tape recorders;
--innovation of record players of medium and upper class, new sources of light, chemical sources of current;
--new instrumentation for medical technology.

8204
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PROPANE-BUTANE ADAPTER SAVES GASOLINE

Prague SVOBODNE SLOVO in Czech 28 Nov 81 p 14

[Text] Experts all over the world are currently endeavoring to replace the traditional fuel for motor vehicles--gasoline or diesel oil--by other sources of energy. A very interesting contribution to this effort represents the research of a team of efficiency promoters from the Highway Transportation Center in Plant 7 of the industrial concern Vitkovice--Iron Works and Engineering Plants of Klement Gottwald [VZKG]. The team headed by D. Horecky built and tested its own system--a propane-butane gas adapter for routinely produced four-stroke spark-ignition engines.

The five-man team began to develop the device in VZKG in 1975 as part of an effort to economize automotive transportation and improve the environment throughout the plant--in addition to their routine duties. While similar systems are designed abroad for liquid gas, in Vitkovice they came up with their own original solution: gaseous propane-butane.

The principle of the system consists in feeding propane-butane to a pressure reducing valve in gaseous state and from there into the main fuel system of the engine. It also makes use of a circuit for preheating the propane-butane charge to promote utilization of the entire contents of the pressure bottle. Its control and safety system is automated by means of semiconductor technology, whereby preparation of the propellant mixture itself is taken care of by a pressure reducing valve of their own design. The original system received the designation AP-VB-1 and, after some improvements, it became the updated AP-VB-2.

The new system does not interfere in any way with the function or structural design of a conventional gasoline engine and its fuel circuit. The vehicle can be driven independently by gasoline as well as by propane-butane, meaning that the type of fuel can be switched, even during operation, just by flipping a switch on the dashboard. Thus, the gasoline engine remains in its original state, only a gas jet is attached to the carburetor. The authors of the system cannot mention and analyze further technical details; it involves a Czechoslovak patent protected by an authorship certificate.

Tests of the new system were carried out recently in the Testing Institute for Engineering, State Testing Center 202 in Brno. Their assessment of it was very favorable. They commended primarily its reliable and safe operation as well as good starting with either gasoline or propane-butane. For that reason the test center issued for the system a decision of approval as meeting the provisions of relevant legal measures and recommended its dissemination.

Other advantages offered by the system are its minimum failure rate, smoother engine operation and less wear on the engine, longer service life of its oil, etc. Operation with propane-butane will also be a cause for rejoicing among ecologists, because while the contents of carbon monoxide in exhaust gases of the gasoline engine during idle run turned out to be 3.5 percent and approximately 2.5 percent during driving, these values for propane-butane ranged between 0.5 and 0.3 percent. Excluded is also the possibility of polluting the atmosphere by lead compounds which are used in gasoline as an anti-knock additive. For that reason use of gas for driving motor vehicles is desirable not only in enclosed areas, but also in spas and recreation centers--simply everywhere where we strive to improve the living and working environment.

The VZKG has already a several years' experience with the use of the adapter in vehicles Skoda 1203 and, as shown by analyses, worthy of note is also the comparative fuel cost. The Skoda 1203 negotiates 100 km with Kcs 80 worth of gasoline (and more), the propane butane cost for the same distance: Kcs 20.

The system AP-BV-1 and 2 came into being thanks to the great enthusiasm of the efficiency promotion team in VZKG who worked on it in addition to their tasks. Even though they built it--as they say themselves--actually "from scratch," the adapter for conventional four-stroke ignition combustion engines for propane-butane in gaseous state was tested and approved by the testing institute in Brno.

For the time being things have come to an end. The VZKG plant, due to being oriented toward another production program, cannot market this new system by itself, but no other organs have shown any interest in it either. Drive systems using gas are already in use in the USSR (some taxicabs in Moscow), also in France, Japan, the Netherlands and other countries. The first heralds did also turn up in the CSSR so that we now have at our disposal a domestic system which in its way is better, simpler and cheaper.

8204
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COMPUTER SIMULATION IN HYDROCARBON EXPLORATION

Budapest MAGYAR HIRLAP in Hungarian 27 Nov 81 p 7

[Article by Péter Tromboczky: "Hydrocarbon Exploration--One Billion Yearly"]

[Text] Yesterday afternoon, in Szazhalombatta, Industrial Secretary of State László Kapolyi inaugurated the 210-million-forint central plant of the Hungarian Hydrocarbon Industry Research and Development Institute.

What would have happened if they had originally altered important decisions? A fiasco could have been avoided. This is, however, hindsight: life's path is unique and unrepeatable. And not only the path of human lives...

And then, before the change caused by the decision takes place--the change takes place. Before the unexpected and irritating loss caused by the mistake irrevocably occurs--the loss occurs, although it may be recovered, if they say: "this way" or "that way," maybe after 15 years. It would be good to know ahead of time. And they find out. It is neither magic nor prophecy but engineering computation: mathematics, and physics, physical chemistry and chemistry, fluid mechanics, geology and rock mechanics, a large number of measurements, laboratory experiments and many other things.

It Would Be Good To See

In order to make the picture--still confused--clearer, we must know a few things. For example, we must know that only a certain portion of the oil hiding in the pores and tiny clefts of rock can be produced. The size of this portion, however, depends on a number of factors--among other things, on the density of wells located on the oil deposits and their output rate. If the suction effect is high, depending on a good many varying physical parameters, to a lesser or greater degree, gas can enter from the top and water from the bottom; conditions change fundamentally--to put it simply: more oil remains between the wells in the deposits. Of course, it would be possible to use more wells, but a several-thousand-meter-deep well is not cheap. But then we have to produce in more moderate quantities. Thanks to which the total producible oil will increase; but, needless to say, it is not unimportant when it can be produced. To stretch out production is as uneconomical as to force it, ignoring losses. Thus we have to find the solution that is optimal both technically and economically.

Relations are even more complicated than those outlined above; each oil deposit has its own characteristics. At the same time, the deeply located oil deposit cannot be completely discovered, since out of an area of several square kilometers only a few times 10- or a few times 100- square-decimeters is drilled from which geological information can be gained. This information is enhanced only to a certain degree by geophysical and fluid mechanics measurements. And finally, consider Heisenberg's idea according to which: "we cannot make any observations without disturbing the observed phenomenon"; this is valid not only for nuclear physics. It is very true for oil and natural gas deposits, since data can only be obtained by means of this "disturbauce," in the course of drilling and production.

And a hydrocarbon deposit (like a human being) has only one life. Still it would be necessary to see ahead: What results from the mode and level of production and from any other intervention, oil forced out by water or gas infusion. It would be beneficial to know the fate of the deposit in several possible versions, to be able to choose the most economical one. This possibility is offered by computerized mathematical simulation, which "plays out" the processes years in advance, in an accelerated manner. Computerized, because the complicated and interdependent changes of parameters can only be traced and predicted this way.

So-called production planning, the development of extrusion methods, is just one branch (although an important one) of the extremely diversified activities of the Hungarian Hydrocarbon Industrial Research and Development Institute. Still perhaps it is worthwhile in this context to mention simulation a bit more in detail to find out at least in one small area how complicated and interdependent even a single research effort is.

Destiny of Assets

The scope of the institute formed on 1 January 1980 is, however, much more extensive. The new base merged together from three institutes practically encompasses the entire spectrum of the oil and natural gas industry; moreover, research extends to the related chemical industry technologies.

The economic importance and weight of these activities is perhaps illustrated by the recently published list of the Club of Hundreds. According to the 1980 production assets, in the ranking of the largest companies in the country, number one is the Danube Oil Industry Company, number two the Nagyalfold Oil and Natural Gas Production Company, and a good many hydrocarbon companies are also members of this club. Thus indicates that the Szazhalombatta Institute can influence the destiny of sizable assets.

Thanks to the new central plant, this institute will be able to function even better than ever before, since the work is performed not in isolated and obsolete barracks, but rather in a civilized workplace, equipped to match the difficulty of the task, in well-equipped laboratories, with the help of a carefully conceived computer center and scientific information base (technical library and 500 periodicals, including 350 Western publications). The regional bases, mostly located near the Alfold and Dunantul companies will, of course, be

maintained--i.e., they will remain "near industry." But even the working conditions of researchers employed in those facilities will improve. Among other things, they will have access to the Szazhalombatta computer center via their intelligent terminals, connected through a telephone line and usable independently.

Use and Benefit

Most of the topics being worked on in the institute are applied research and development; the activity, however, extends beyond the desk and the laboratory. For the sake of resultful practical application, inplant experiments are conducted, and complete technologies are developed, partly independently and partly together with the branch industry. Today I could mention about 25 such larger subject areas, already used in the oil industry. Among them, several have well measurable economical benefits, while others can at best be estimated, since they can only be compared to a still unimplemented and less optimal version. An example of the first group is the branch-industry-level computerized production planning, developed for the process industry, which brings in 5-10 percent extra profit by coordinating transportation, processing and product distribution. But the development of lubricating materials and additives replacing imports has also resulted in substantial savings. The second group is made up by those research topics that, for example, allowed the application of drilling technologies adapted to special domestic conditions or production based on the optimal exploitation designs mentioned at the beginning.

The profit originating from the research and development activities of the institute is estimated at 1 billion forints by the leading experts of the branch industry, and perhaps this number indicates best the significance of the multifaceted and rather specialized activities.

9901
CSO: 2502/27

SOFTING: HUNGARIAN SOFTWARE IN WORLD VANGUARD

Budapest SZAMITASTECHNIKA in Hungarian Sep 81 p 10

[Article by Laszlo Kruppa: "The SOFTING Technology: Hungarian Software in the World Vanguard"]

[Excerpt] In very few places in the world so far do they use a developed software manufacturing technology which gathers into a system and supplements with new products the extensive software tools now available. Such a technology is built on a complex computerized software development system, the latter being--in regard to its functions--a complete analogy of the automated technological line of machines known from industry. If we accept this analogy we can speak of lines of machines which manufacture software, where the line is made up of virtual machines, that is, of operating software elements.

This technology was first used several years ago in the American Department of Defense. The reliability of systems prepared in this way increased to a gigantic extent, not even to speak of the reduction in manufacturing time. Previously, in the development of very large systems (for example, the Apollo Program), they used the refined tools of team work to achieve similar reliability. This required significant over-insurance and the work of very many people.

Manufacturing Lines

It is characteristic of automated software manufacturing or developing systems--as it is of a large technological line of machines--that relatively few people are required to service them while through-put increases to a great extent. Since software manufacture is a rather new branch of industry the software houses of the world are only now beginning to achieve that production volume which requires an "automatic production line" or a complex software development system. But there is no system on the market. At least not yet.

The Essence of SOFTING

After such antecedents the significance of the joint undertaking of the SZAMOK [Computer Technology Training Center] and the SZKI [Computer Technology Coordination Institute] is perhaps more understandable. One team of programmers from each of the two institutes has been working for about a year and a half to create an automated software development system within the framework of the SOFTING project. The matter is very significant from both the professional and business viewpoint because such

a system has not yet been used in the "civilian sphere." The name of the software development apparatus, SOFTING, is a witty abbreviation reminiscent of a new English word which refers to software manufacture.

The diagram shows the structure of the combined system made up of a number of components. The several subsystems carry out different functions and are linked to one another like links in a chain. We should understand the latter to mean that the input information for each subsequent subsystem is based on the data processed by the preceding subsystem.

We can take the block diagram which can be seen in the SOFTING diagram as the general technological course of software manufacture. Let us look at it step by step:

1. The problem which is to be solved is defined on the basis of the system plan (rendszerterv).

2. With the aid of the SOFTSPEC system we give the specifications of the system to be developed, or we check these specifications.

3. SOFTCON performs program design and evaluation.

4. SOFTGEN is program generation.

5. We receive the solution (megoldas) in the form of programs in the IBM Assembler, COBOL or PL/I languages.

6. SOFTDOC provides automatic program documentation and static analysis.

7. SOFTTEST provides dynamic program testing.

8. SOFTINT provides system testing and integration.

9. The finished software can be used to solve the initial problem.

Cooperation

The man with the idea, and the professional leader of the group made up of the SZAMOK and SZKI teams, is Harry Sneed, an energetic American. As founder of the FRG firm called SES GmbH he also undertook a large part of the financing of the business. So the SOFTING project is being realized in a three-way cooperation. The profit will be divided among the three participants, the SZAMOK, the SZKI and the SES GmbH and the "invisible" partner, Metrimpex, which takes care of the foreign trade deals. By means of good professional and business tactics the two programming teams succeeded in dividing up the work between them so that while the SOFTING subsystems relate to one another the individual components being gradually prepared can be marketed separately also. It is thanks to this that a number of the SOFTING components to be completed first and which have been accompanied by international interest (FRG, Sweden, etc.) have been sold or leased out already.

The selling price of the subsystem is 25,000 West German marks. For the time being the market situation is such that it is not possible to satisfy every potential customer because the members of the team, primarily burdened with development, do not have enough time for the installation which is obligatory at the time of sale.

According to the business policy which they hope to realize the SOFTING project should be profitable even in the developmental phase.

We have not yet spoken of the time factor, which has a crucial effect on the success of the project. It is nevertheless obvious that in order to pluck the moral and material "laurels" offered by the market situation the Hungarian enterprises, which have only sparse western references, must appear with their product before the others. And these "others" are not resting. (Certain Japanese colleagues, for example, have already largely developed their competing system. The leader there also is an American.) So there is a race which it would be good to win.

A Few Professional Details

SOFTDOC, the first subsystem to be completed, is written in PL/I and can be run under IBM DOS/VS, OS/VS or MVS operating systems. SOFTDOC performs automatic analysis and documentation of already prepared software products. With its aid one can review those program systems which, because of their size and complexity, cannot be operated well--or cannot be operated at all--the correction of which is virtually impossible. And this is a very frequent phenomenon.

The name of the next component to be finished, by the SZAMOK alone, is SOFTTEST. This subsystem, performing dynamic testing of programs, will be larger and more expensive than SOFTDOC. Although it is not yet finished there are already customers for it. The installation of SOFTDOC is now under way at the Bertelsmann firm in the FRG so that SOFTTEST, which will be ready in the near future, can be put into operation without delay. (The running of SOFTDOC is a precondition for the operation of SOFTTEST.)

The SZKI team is now working on the development of the SOFTSPEC component.

8984
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NEW FLUID RECOVERY PROCESS ACCELERATING DRILLING OPERATION

Bucharest REVISTA ECONOMICA in Romanian No 48, 27 Nov 81 p 6

[Article by Horatiu Seiceanu, Minister of Petroleum]

[Text] An increase in the production of oil, and of hydrocarbons in general, is a priority requirement for assuring the fuel needs of the economy and meeting the demand of the chemical industry. An analysis of the activity carried out during the first ten months of the year, shows that the results obtained so far have been below planned levels. One important factor among the many contributing to this situation, is the drilling activity: the program for starting new productive wells has not been completed on schedule because of shortcomings in this activity. At the same time, extraction trusts have also failed to perform a satisfactory activity, a fact which has had negative repercussions on the fulfillment of plan provisions.

As has been pointed out in the most recent party documents, it is the duty of all responsible factors, beginning with drilling enterprises, extraction derricks, and trusts, and ending with the ministry, to concentrate their efforts so as to eliminate existing shortcomings and create all the conditions which will allow the recovery of delays, and the complete fulfillment of plan tasks.

Under these conditions, particular attention is being devoted to drilling activities, and especially to very deep drilling, in order to exploit new hydrocarbon reserves. Because high temperatures and pressures are encountered as depth increases, drilling activities have raised--and still raise--special problems in developing appropriate work techniques. Because of this, drilling fluids are very significant in proper well formation.

Until recently, the fluids used for well drilling were stored in pits dug into the ground, which were generally abandoned once the wells were placed in operation; this created problems in returning the land to agricultural use. What is more, a number of expensive substances, such as barite, remained in the abandoned fluids. These considerations imposed a reorientation in the design of surface equipment available at installations, as well as in the possibilities for efficient reutilization of the drilling fluids left behind after well completion. It became a matter of building systems which would allow the centralized collection of surplus fluids from wells, their transportation in special installations for eventual treatment to restore their properties, and their reutilization in other wells. By means of this cycle, very good revalorification results are obtained for some components, with great reductions in specific consumptions.

Time spent on:	1980	1981 (9 months)
Bottom drilling (%)	26.2	29.6
Bottom drilling (hours)	81,925	99,340
Controlling fluid losses (%)	1.2	0.78
Auxilliary work and fluid preparation at the well (%)	21.3	20.7

The interest of researchers in this domain was finalized in the design and construction of nine central fluid stations equipped with mechanized devices for preparing, cleaning, and treating drilling fluids, and with capabilities for storing them according to type. The most efficient solutions were analyzed as part of these standardization projects, concluding that the construction of stations in 500 cubic-meter modules is appropriate for field conditions, allowing the optimization of capabilities or of lines for preparing special fluids, to meet the dynamics of drilling activities. A special contribution in the recovery and reutilization of drilling fluids has been made by the Automatica enterprise of Medias, through the construction of the special tanker truck CFF-1, with a capacity of 10 cubic meters and a useful load of 16 tons. The endowment of drilling derricks with 120 special tankers of this type has increased the volume of recovered fluids to 61,600 cubic meters in 1980, and during the first nine months of 1981, the placement in operation of new central stations has brought the volume of recovered and reutilized fluids to 44,000 cubic meters.

The first effect of this action has been to reduce the consumption of barite--about one-half of which is imported--by 9000 tons in 1980; it is expected that the total volume of barite reutilized through recovery will exceed 9500 tons in 1981. The savings achieved during the first nine months of the year (about 7800 tons of barite) amount to approximately 12 million lei.

Since the integration of central stations for fluids into well drilling activities, improvements in the quality of fluids have also improved drilling indicators for those trusts that are endowed with such stations. At the Moinesti Oil Trust for instance, an efficiency higher than that of last year was noted during the first three quarters of 1981, resulting directly from the action of drilling fluids in technologic processes (see table). Some other similar results of this activity are: it eliminated the digging of storage pits at 45 wells in Moinesti alone, which amounts to about 2 hectares of agricultural land; reduced the transportation of chemicals to wells being drilled; achieved fuel and energy savings by abandoning the use of 800-1250 hp pumps at stations for the preparation of drilling fluids; returned immediately to agricultural use, the land temporarily assigned to wells, and avoided environmental pollution; and it provided an additional 8000 hours allocated to drilling, resulting in an additional 16,000 meters drilled with the same equipment and personnel, which in only five months would represent an additional 105,000 meters drilled nationwide.

The utilization possibilities of central stations for fluids are far from exhausted. Recent research at the Institute for Petroleum and Gas Research and Design, in Cimpina, has disclosed that as a result of chemical treatments performed at wells, the marls traversed by the drill and transformed into drilling fluid through the addition of water, become activated with a yield of more than 12 cubic meters of

fluid per ton. The transformation of these fluids into powders through atomization, would represent a source of raw materials for the oil extraction industry, for waterway improvements, for use in foundries, and so on. At the same time, the atomization of heavy fluids with high barite contents, would not only allow easy storage of their constituent solid substances, but would also make it possible to instantly prepare fluids with a desired specific gravity, simply by disolving these substances in water and reusing them in wells which require greater amounts of fluids. However, this operation also involves some energy consumption, which according to laboratory experiments amounts to 200 N cubic meters of gases per ton of powder created by atomizing drilling fluids. Despite this, the process deserves a more detailed analysis, seeking the most economical solutions from an energy standpoint, such as the use solar energy for preheating, and so on, since the effects of the process' application would ultimately lead to substantial savings through fluid recycling.

Given the advantages that can be derived from the construction of central stations for fluids, it can be seen that their standardization in modules creates the basis for integrating all drilling activities into one system, so that the action could be completed during the current five-year plan. This is facilitated by the fact that the equipment of central station modules can be fabricated entirely in our country by units of the Ministry of Petroleum (tanks, stirrers) and the Ministry of the Machine Construction Industry (centrifugal pumps, metal fittings, valves, and so on). At the same time, greater concern is required on the part of trusts, to act more firmly in this direction; as well as on the part of land and territorial organization offices in county people's councils--especially in the counties of Arges and Timis--to more efficiently complete approval formalities for land utilization.

The combination of the positive effects mentioned here argues in favor of building and using central stations for fluids as rapidly as possible, so that this new and efficient system with ultimate positive effects on higher oil production, will be extended throughout all drilling activities.

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DETAILS OF 1980 POWER BLACKOUT, PREVENTIVE MEASURES VIEWED

Ljubljana ELEKTROTEHNICKI VJESNIK in Serbo-Croatian No 1, 1981 (manuscript received 29 Jan 81) pp 1-7

[Article by Dr Marjan Plaper, graduate engineer and professor at the School of Electrical Engineering of Ljubljana University: "Disturbances in the Operation of Yugoslavia's Electric Power System"]

[Text] 1. Introduction

All present-day electric power systems are susceptible to damage to some extent. An electric power system which would guarantee 100-percent reliability of supply to consumers would be outsized and extremely expensive. That is why in every system today there is some probability of operating disturbances. The seemingly harmless failure of just one element in the system can sometimes cause the successive failure of key facilities and a partial breakdown of the system with serious socioeconomic consequences.

Let us merely recall the disastrous power "blackout" on 9 November 1965 in the eastern United States (Consolidated Edison Company of New York), when 30 million customers were affected and when it took 13.5 hours to put the system back in order. There have been less severe disturbances in the same area in 1971, 1972, 1973, 1974, 1976 and on 13 July 1977 there was again a sizable breakdown affecting 2,725,000 customers; since it took all of 25 hours to put the system completely back in order, the socioeconomic consequences were even greater than those in 1965.

A power blackout affected virtually all of France on 19 December 1978, and soon thereafter Vienna and after that Sweden as well. The damage in France was estimated at the time between 3 and 4 billion francs, which today would represent between 20 and 25 billion dinars. The situation in which the breakdown of the French electric power system occurred in 1978 was similar to the situation on 8 December 1980 in Yugoslavia, when at 1605 hours a power blackout affected several of our republics and provinces. There was the difference that supposedly an improper rate policy at that time encouraged the French to make exaggerated use of electric power for residential heating, while in our case there was excessive consumption of electric power because of the general energy crisis which has already affected the entire civilized world.

2. Characteristics of the Yugoslav Electric Power System

A relatively large growth of electric power consumption was recorded in 1980 (9.6 percent, while the average over the last 10 years is 8.8 percent) because of the noticeable conversion of consumers to electric residential heating in the wintertime and also the relatively augmented consumption of what are referred to as direct (large) customers. During cold spells consumption increased even more than 20 percent over the same period in 1979.

At the end of 1980 the Yugoslav electric power system had 224 generating units in hydroplants, thermal electric power plants and heating plants, distributed as follows:

i. 70 units in thermal electric plants with a total installed capacity of 7,098 megawatts, or 54.2 percent of total capacity (42.2 percent fired by coal, 9 percent by oil and 3 percent by gas);

ii. 154 units in hydroplants with a total installed capacity of 5,995 megawatts, or 45.8 percent of total capacity (19.7 percent run-of-river, 22.9 percent storage and 3.2 percent reversible).

Hydrological conditions were highly favorable in 1980. The occasional shortage of coal at certain steam plants (Kosovo, for example) and oil-fired plants did not have severe consequences (gas-fired plants were put on line in exceptional cases to handle peak loads).

We should mention that normal operation of an electric power system requires a certain reserve of sources of energy in storage reservoirs, stocks of coal and oil at steam plants, a "cold" reserve of standby steam plants to cover major equipment breakdowns (about 10 percent of installed capacity of steam plants) as well as "hot" backup capacity to cover sudden failures (about 5 percent of the capacity on line). The electric power industries of Yugoslavia's republics and provinces by and large provided the "hot" standby capacity in 1980 necessary to cover failure of plants and transmission facilities, and they came to each other's aid in case of failures. This ensured the necessary reliability in operation of the system except at peak loads in the system. Linkage and parallel operation with the West European electric power interconnection of UCPTE contributed greatly to increasing the stability of the system's operation [1]. Figure 1 shows how the demand was met in average operating days on a month-by-month basis in 1980. One can conclude from this that there was a net balance in terms of power and foreign exchange with foreign countries in that year even if we ignore the other constructive consequences of the linkage involved.

The Yugoslav electric power system consists of eight (in December 1980 it was still six) self-managing republic and provincial subsystems. Each electric power industry is responsible for the development and construction of electric power facilities and for supplying electric power to customers in its area. The electric power industries of these subsystems guarantee the technological integrity of the entire Yugoslav electric power system within the framework of the Community of the Yugoslav Electric Power Industry (JUGEL). Load control centers in the republics and provinces are responsible for monitoring, regulating and

operating electric power facilities, while the federal load control service is responsible for coordinating the operation of the republic and provincial centers in the sense of ensuring the technological integrity of the Yugoslav electric power system and for cooperation with the systems of neighboring countries.

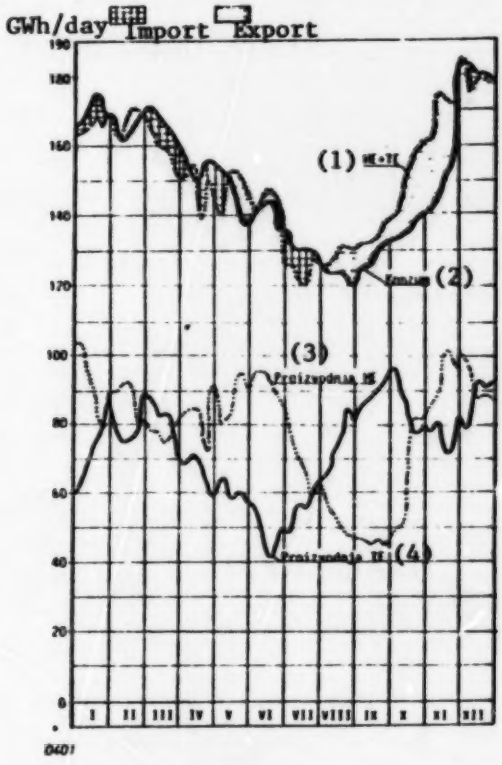

Figure 1. Meeting the Yugoslav demand for power from power plants on average operating days in 1980.

Key: 1. Hydro and steam plants
2. Demand
3. Output of hydroplants
4. Output of steam plants

3. Technical Causes of the Breakdown in the Yugoslav Electric Power System on 8 December 1980 at 1605 Hours

It is evident from the report of the JUGEL load control service that there were several disturbances in operation of the Yugoslav electric power system in 1979 and 1980: 6 in 1979 and 11 in 1980 with sizable consequences. By contrast with 8 December 1980, all the other disturbances were on a smaller scale and more brief, and they went all but unnoticed in the daily diagrams of electric power consumption. The main reason for this was the rapid intervention of the West European interconnection of UCPTE.

It is evident from the daily diagram of electric power consumption on 8 December 1980, given in Figure 2, that the disturbance on that day had quite serious consequences.

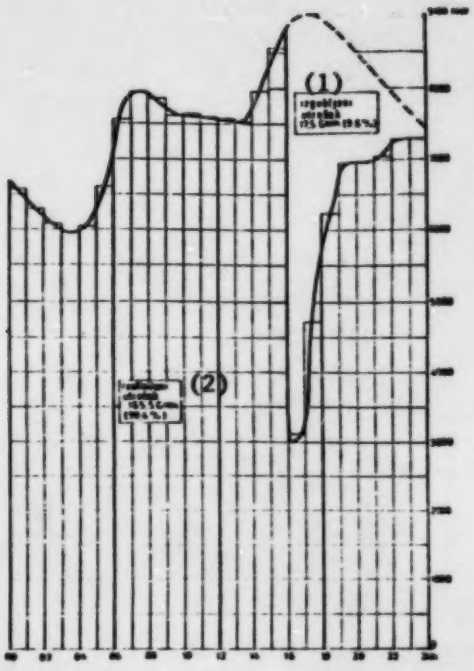

Figure 2. Daily diagram of Yugoslavia's consumption on 8 December 1980.

Key: 1. Lost load ... 2. Load handled ...

On that day there was a loss of 9.6 percent of the day's power, or approximately 17.5 million kilowatt-hours, and if we put a value of $1 (29.5 dinars) on every kilowatt-hour, the loss incurred by our economy was half a billion dinars (new dinars, of course!). It is evident from the daily diagram for Slovenia on that day that that subsystem failed in its entirety at 1605 hours and more than 4 hours passed before it was fully restored.

If we examine the diagram of Yugoslavia's 400- and 220-kv transmission networks on 8 December 1980, given in Figure 4, and compare it with Phase I of the basic 400-kv network in Figure 1, taken from [1], we see that in December 1980 the 400-kv link Trebinje--Titograd--Ravna Rijeka--Kosovo was not in service (the transmission lines had been built, but the substations had not), though as early as October 1978 it had been officially declared that this phase in construction of the network had been concluded. Aside from that, back on 5 and 6 November 1980 there had been extremely serious breakdowns because of disastrous icing (freezing rain!) in Dalmatia, Lika, the Rijeka area and western Slovenia. The most serious damage was on the Brinje--Kojsko (both), Meline--Brinje, Divaca--Meline and Divaca--Pehlin transmission lines. Consequently, in December 1980 practically the entire southern section of the Nikola Tesla 400-kv network from Ljubljana and all the way to Kosovo was out of service, and it certainly would have prevented the disaster in the Yugoslav system at 1605 hours on 8 December 1980.

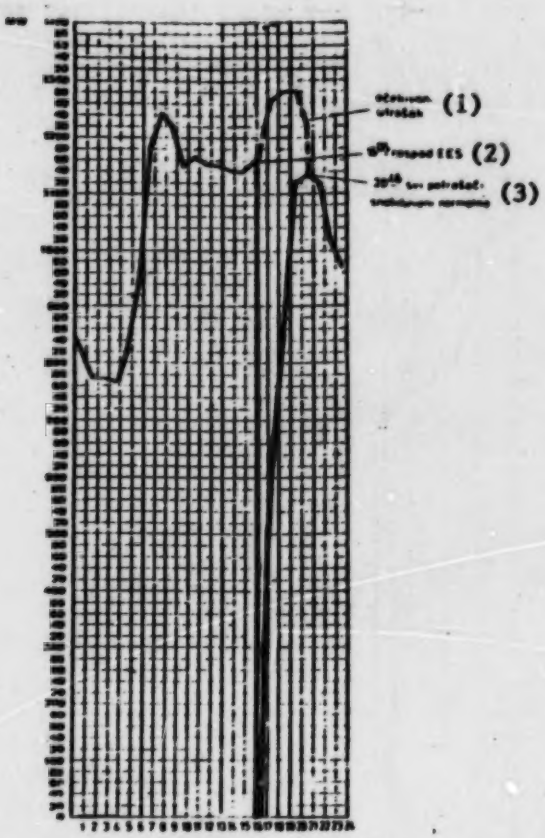

Figure 3. Daily diagram of Slovenia's consumption on 8 December 1980.

Key: 1. Expected load
2. Breakdown of Slovenian electric power system at 1605
3. All customers supplied normally at 2046

A special commission of experts at JUGEL* in Belgrade to investigate the causes of the blackout gathered data on power flows in megawatts on the interrepublic and international transmission lines 5 minutes before the breakdown (at 1600 hours). These figures are given along with the net power balances in the 220- and 400-kv networks by republics in Figure 5. The contribution of the Albanian Mao Tse Tung Hydroplant (directed operation!), intended partly for Macedonia and partly for Slovenia, is indicated as Montenegrin output. The Yugoslav electric power system was operating, as in any case it does, in parallel with the Greek system and the connected system UCPTE 1.

It is evident from Figure 5 that Slovenia, Croatia, Serbia with the autonomous provinces, and Macedonia showed a deficit, while Bosnia-Hercegovina and Montenegro were republics with a surplus. If we draw up a diagram showing Yugoslavia's deficit and surplus areas, the result is Figure 6, which shows that the deficit

* The author of the article was a member of that commission (editor's note).

in Slovenia, Croatia, Serbia and Macedonia on that day total 1,491 megawatts at 1600 hours, which was covered with 10,031 megawatts from the surplus republics of Bosnia-Hercegovina and Montenegro, while 395 megawatts came from UCPTE and 65 megawatts from Greece.

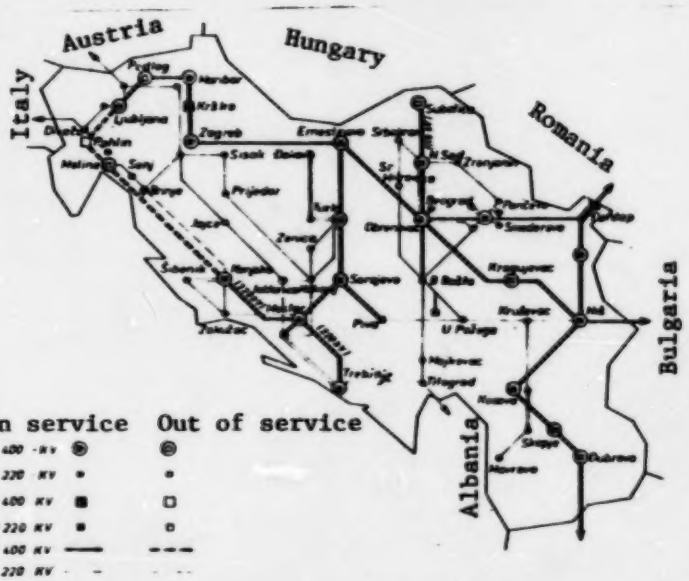

Figure 4. State of Yugoslavia's 400- and 220-kv transmission networks on 8 December 1980.

Key: 1. Substation
2. Circuit-breaker station
3. Long-distance transmission line

In the emergency situation the interrepublic 220-kv long-distance transmission lines between Tuzla and Djakovo were unable to help because of Djakovo's radial feed, nor could the Mostar--Zakucac and Mostar--Konjsko links because transmission lines to the areas with a shortage were either down or out of service, as has been specifically indicated in Figure 6. Only the Tuzla--Ernestinovo 400-kv and Piva--Uzicka Pozega and Titograd--Bajina Basta 220-kv interrepublic links, all of which had a high load, and the Jajce--Mraclin and Prijedor--Sisak 220-kv transmission lines, with a smaller load, were able to help. Only 22 percent of capacity was directed westward from the center of Yugoslavia. The rest received about 400 megawatts from UCPTE, thereby covering 100 percent of Slovenia's deficit and 43 percent of Croatia's deficit. All of 78 percent of the capacity in the center of Yugoslavia was directed eastward. On 7 and 8 December four large generating units and one boiler with a total capacity of 978 megawatts (9.5 percent of the total employed capacity of all power plants in Yugoslavia) went out of service in the subsystem consisting of Serbia and the autonomous provinces. The shortage of power was covered from the "hot" standby capacity of the entire Yugoslav system and with unscheduled imports from neighboring countries. Certainly the needed power had to flow into Serbia from quite distant areas, which put an appreciable load on certain long-distance transmission lines, and because

of the simultaneous shortage of "sterile" power greatly reduced voltages in the area of Serbia where the shortage was.

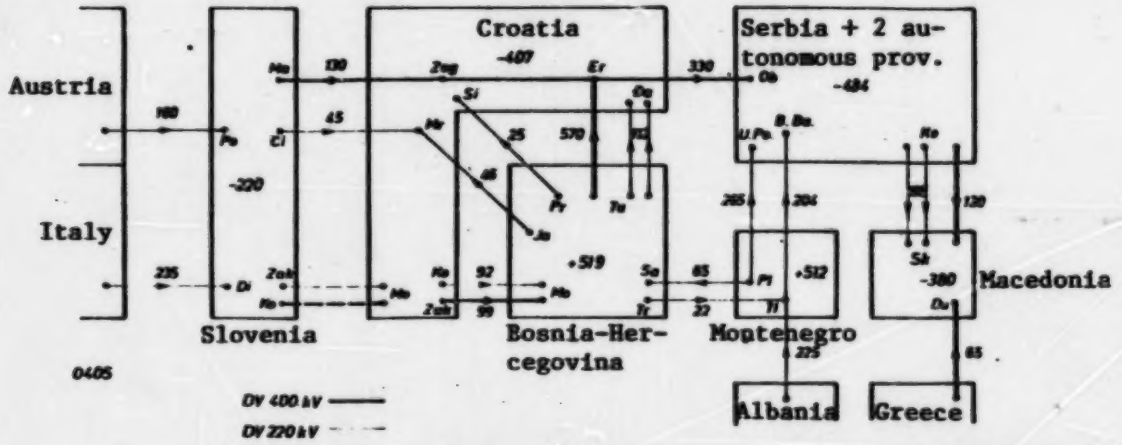

Figure 5. Power flows on interrepublic and international 400- and 220-kv long-distance transmission lines with republic power balances in megawatts at 1600 hours on 8 December 1980.

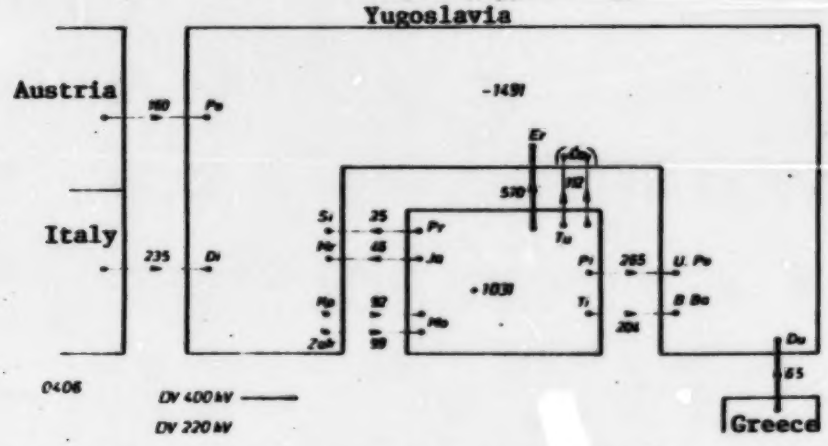

Figure 6. Flows of power (in megawatts) between areas with a surplus and areas with a deficit in Yugoslavia at 1600 hours on 8 December 1980.

At 1602 hours on 8 December 1980 the breakdown began with failure of the overloaded 220-kv Piva--Uzicka Pozega transmission line (overcurrent protection was in operation). Since under these conditions the power must seek longer routes to the areas with the shortage, total transmission impedance jumped suddenly to a higher value, and we can elucidate the phenomenon qualitatively by means of the "equal areas" criterion in the well-known theory of stability. We can compare the model in Figure 6 in part to the model in Figure 7a, where the power flow P between the area with the surplus 1 and the area with the shortage 2 over the equivalent transmission reactance X is:

$P = (U_1U_2/X) \sin \theta$

in which θ is the angle between the voltages U_1 and U_2 at the connection between areas 1 and 2. It is clear that this picture is highly simplified and allows only a qualitative analysis of relatively complicated phenomena.

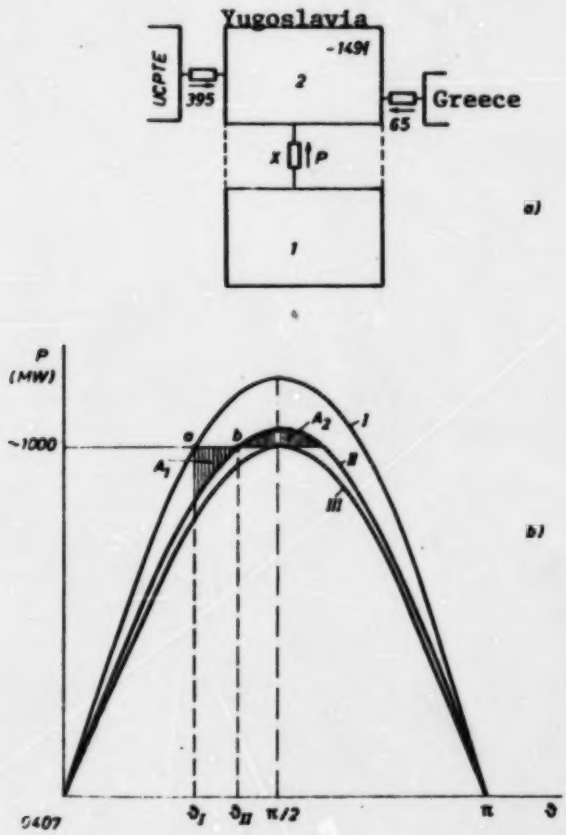

Figure 7. a) Simplified model for interpretation of the events in the Yugoslav power system at 1605 hours on 8 December 1980; b) illustration of the events by the conventional criterion of "equal areas."

In Figure 7b the operating point in the initial stage of equilibrium on the sine curve I determines the angle of stability between areas 1 and 2 θ_1. When the Piva--Uzicka Pozega connection failed, the total transmission reactance X between areas 1 and 2 suddenly increased, the voltage U_2 at the heart of the region with the shortage dropped (because of the low voltage U_2 the amplitude of the curve I for transmission of 1,000 megawatts was relatively low!). That greatly reduced the amplitude of the sinusoid (curve II in Figure 7b). That caused a power fluctuation on the order of 1,000 megawatts around the new operating point b on curve II, which shook the entire Yugoslav electric power system. When the highly loaded 220-kv Piva--Uzicka Pozega link failed, a new state of equilibrium had to be stabilized at point b on curve II, that is, a higher angle of stability attained between the two areas.

Probably even at that time there was a surplus of kinetic energy of rotating masses in area 1 (acceleration) equal to or even greater than the shortage of electric power in area 2 (deceleration), that is, the area of acceleration A_1 in Figure 7b was equal to or even greater than the area of deceleration A_2 and thereby threatened stable operation or even made it impossible. The possibility of stable operation was diminished still more by the failure of the highly loaded 220-kv Titograd--Bajina Basta long-distance transmission line. The additional increase of X and additional drop of U_2 diminished even more the amplitude of the sine curve, and probably the stable operating point for transmitting 1,000 megawatts of power vanished altogether (curve III in Figure 7b).

The 220-kv links with UCPTE, which are weak and highly loaded for present operating conditions (the Divaca--Padrice ring of SUDEL was loaded with a flow of 235 megawatts in the direction of Yugoslavia!) deteriorated even more the critical situation, since they were unable to withstand the stability fluctuations.

Following the successive failures of the highly loaded Piva--Uzicka Pozega and Titograd--Bajina Basta 220-kv links, the separation of the Yugoslav system from the UCPTE interconnection and Greece (with a shock shortage in Yugoslavia of approximately 500 megawatts), the rapid drop of frequency and the successive failures of power plants in the areas of our country with a shortage were a logical consequence of the convulsive and unsuccessful search for a new state of equilibrium for a power flow of about 1,000 megawatts between the areas of Yugoslavia with a surplus to those with a shortage. Within the country it was no longer possible to attain that state with the connections that still existed. It is also clear that the subsystems with a surplus, Bosnia-Hercegovina and Montenegro with Dalmatia and a part of Slavonia, stayed in operation after a brief rise of frequency.

4. Certain Measures for Safer Operation of the Yugoslav Electric Power System

It is stated in an article listed as [1] that back on 1 August 1971 an agreement was signed in Yugoslavia among the relevant enterprises concerning the foundations of parallel operation of domestic and foreign systems. The Yugoslav electric power system, taken as a technological unit, was not at that time so clearly divided into republic and provincial subsystems as it is today, which accounts for the omission of many provisions concerning parallel operation which we find in the new self-management accord prepared in November 1980 [2], and which had not been signed even in late December 1980.

The new self-management accord [2] (the provisions of the 1971 agreement remain in effect until the signing) regulates mutual reconciliation of electric power budgets, the assurance and use of the total reserve capacity in Yugoslav power plants, the coordination of weekly and daily operating plans of power plants and transmission connections, the transit of electric power, exports, imports and exchange of electric power with foreign countries, secondary regulation of the electric power system, coordination of operational management of the 400- and 220-kv transmission networks, coordination of projects related to development and maintenance of the technical system for load control, mutual adjustment of parameters of electric protection and characteristics of turbine regulators. It also contains provisions on the committee for joint operation and the load control service of the Community of the Yugoslav Electric Power Industry.

The 1971 agreement precisely defined secondary network regulation, but had absolutely nothing to say about primary regulation. But secondary regulation can in no way take the place of primary regulation. It is evident from the study listed as [3] that primary and secondary regulation must complement one another, since both methods of regulation have a limited capability. Primary (turbine) regulation, which automatically and on a regional basis forces the generating unit to deliver greater power when there is a drop in frequency, has essential importance in emergency situations in the parallel operation of large systems. A majority of the units in Yugoslavia operated in the past with turbine regulation "blocked." In the UCPTE countries today they regard that mode of operation as a poor and dangerous habit. They say: operate power plants according to schedule (with constant load) yes, but by no means without statics. After the poor experiences in large systems, the terms "statics" and "self-regulating factor of the system" are again at the center of attention. Attention has increased especially with the introduction of the larger thermal units, which has not been cooperating in primary regulation, so that the regulating characteristics of electric power systems have deteriorated greatly. The rule in the UCPTE interconnection is that all power plants are to collaborate in primary regulation. Every plant which in a critical situation is not cooperating with the appropriate statics (they speak of 4 to 6 percent) is at the very least contributing to the system's failure. The statics of the machines is also a precondition for attainment of a usable self-regulating factor of the system (and the statics of the system), which we can attain only when all the machines cooperate. Only under such conditions is it possible to achieve a smaller drop of frequency in emergency situations until the slower secondary regulation reacts and normalizes the frequencies.

It has been established by experiments for 1971 that the self-regulating factor of the Yugoslav electric power system is approximately 300 MW%Hz. This factor has risen somewhat in subsequent years, but it is certainly too low in view of the growth of the power of the Yugoslav system. Because the contribution of our primary regulation is too small, that is, because the respiration of the Yugoslav electric power system by means of primary regulation is too weak, sudden imbalances between load and production are imparted too rigidly to the international connections and cause situations threatening partial or complete breakdown of our electric power system.

Normally the transmission lines making the link with the UCPTE interconnection ought not to be fully employed in importing electric power into Yugoslavia. This means that the simple capacities of those transmission lines ought to be so great that they can take over the failure of the largest unit in Yugoslavia without threatening interruption of connections with the UCPTE interconnection. Since at present the largest unit in Yugoslavia is operating at Sostanj and has a threshold capacity of 294 megawatts, the most we should be importing from Austria and Italy is a total of about 60 megawatts. According to international recommendations [3], the total effect of these links, taking the capacity of the Yugoslav system at 10,000 megawatts, should be at least 500 megawatts for parallel operation to be advisable at all. The effect of the existing 220-kv SUDEL ring [7] barely reaches 350 megawatts and until the Divaca--Redipuglia 400-kv link goes into service, it is the most pronounced bottleneck in parallel operation of the Yugoslav electric power system with the UCPTE interconnection.

The commission of experts of the Community of the Yugoslav Electric Power Industry learned among other things that system protection in Yugoslavia on 8 December at 1605 hours was not functioning properly and that only in Croatia and Bosnia-Hercegovina was the value at which the underfrequency relays tripped in conformity with the provisions of the self-management accord, while in all the other republics and autonomous provinces the value at which the circuit breakers opened was far below the agreed level. The reliability of undercurrent protection during disturbances is in any case highly problematical and it would be good to think about more effective capabilities for taking the load off electric power systems (even at nominal frequency) [4].

5. A Look Into the Future

Though over the past 5 years (1976-1980) power plants with a capacity of about 5,000 megawatts have been built in Yugoslavia, the gap has not yet been closed between the growth of production and the growth of consumption of electric power, which has been growing faster than the growth of new plant capacities. The world energy crisis and problems that have arisen in our country in connection with the increasingly difficult conditions for obtaining a supply of petroleum and gas threaten in future a still wider gap between the production and consumption of electric power and a still greater probability of disturbances in our electric power system.

In future we face large tasks in the area of more intensive development of domestic sources of energy and their more optimum utilization, especially because of the need to replace imported energy as much as possible by domestic energy. Faster use will have to be made of the hydroelectric potential (only 40 percent of it has so far been utilized in Yugoslavia!). Steam plants with large units at lignite mines will have to be built more rapidly, especially at the sites already designated, nor is the exploitation of nuclear power in last place, and business people in the world are still predicting it will have a great future in generating electric power in spite of the opposition of ecologists [5].

Today there is a great deal said about various alternatives whereby humanity would solve problems connected with energy. But in this area there are still too many people with a euphoric outlook, while in realistic terms there are not so many optimistic explorations; too little consideration is given to the inevitable patterns in the technological development of energy processes. In general we distinguish five phases in the technological development of energy processes:

1. The process has not been scientifically studied. This is the case, for example, with the use of nuclear energy by the process of controlled fusion.

2. The process has been studied scientifically only in the laboratory. This is the case, for example, with the process of direct conversion of solar energy to electric power.

3. The process has been studied at the engineering level on small-scale prototypes and has not yet been put into industrial production. An example of this would be conversion of coal to gas.

4. The process has been studied at the industrial level with equipment of the size envisaged, but they still are not economically profitable. This is the case, for example, with nuclear breeder reactors.

5. The process has been studied even at the economic level with efficient equipment: fossil fuel steam plants, power plants with light-water nuclear reactors, hydroplants, and so on.

The transition from one phase to the other toward the fifth phase, which is the target, is usually a rather difficult and prolonged one and depends greatly on the intensity of relevant research. Realistic energy experts in the world expect very little from unconventional sources of energy (the sun, wind, the tides, geothermal energy, and so on) as sources of electric power in the first decades of the next century [5]. In an international conference in Milan in April on alternative energy sources to solve the energy problems of Europe as a whole three factors were primarily mentioned as solutions: nuclear power, mutual linkage of electric power systems and accumulation of energy with reversible power plants [6]. These factors should also facilitate easier inclusion of those sources of energy which are incidentally highly variable and cannot be accurately predicted, such as direct use of solar energy. Because of the shortages which threaten in the energy supply, these factors ought at the same time to be the principal measures used to attain minimum vulnerability of European electric power systems. At the same time there must certainly not be any neglect of every measure toward energy conservation and toward maximum efficiency in the use of existing sources of energy.

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28 January 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 730

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28 January 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

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LACK OF CEMA COOPERATION IN ELECTRONICS DEPLORED

AU291352 Bratislava PRAVDA in Slovak 28 Dec 81 p 1

[Editorial: "Words Do Not Deepen Integration"]

[Excerpts] The progress being made in introducing electronics into the national economy is slow. This is felt especially by our engineering, which has lost (and, deplorably, continues to lose) more than one position on foreign markets only because the products it offers have a low share of electronics.

The problem lies in the outdated component base, which is no longer commensurate with present needs. Our designs would live up to the present demands were it not for the fact that often we lack the base for the designs. The problem has yet another aspect; some advanced microelectronics components being produced in our country are, because of their price, hardly accessible and excessively burden the production costs--this is what the designers claim. The production sector denies this. Given our broad range of components, it is very difficult to keep abreast of the high pace of innovation [in the world]. Introducing mass production and thereby making it less expensive is another problem.

Is this a vicious circle from which there is no way out? Indeed, but only for those who continue to indulge in the notion that to be up to the world standards means to be able to produce everything single-handed, whatever the cost. Let us ask: Is it within the Czechoslovak economy's capabilities--considering its limited raw material and production potential and, in particular, the fact that electronics has been neglected for many years--to come to terms with the economy's electronicization [elektronizacia]? An answer in the affirmative can only be given when we make broader use than heretofore of the possibilities offered by socialist integration, by production sharing and specialization (as regards both components and individual clusters of components) with CEMA countries and the Soviet Union in particular.

Past experience, when every koruna invested in the CSSR in the development of scientific-technical and production cooperation with the Soviet Union yielded almost KC$8 in final effects (!) should finally open the eyes of the helsmen of our electrotechnical industry. Or is it perhaps possible to doubt the ability of the country that dictates progress to the world in space research, in the use of nuclear technology and in other areas of scientific-technical development to master the technology for the development and production of things such as microelectronics systems or microprocessors?! Is it not a great pity that we are not

able to make full use of the vast economic, scientific and production potential of the land of the Soviets (it accounts for up to 70 percent of the CEMA countries' total social product) with its roughly 1.5 million highly qualified experts working in the scientific-research base alone? There are also possibilities for close cooperation with the GDR, which has mastered technological facilities for microelectronics.

To make things clear, cooperation with the fraternal countries is based on mutual benefit and equality. It obliges us, therefore, not only to take but also to give. It would be a mistake to assume that we can pay for assistance in electronics with products of the footwear or glass industries. The partner rightly expects, on the basis of reciprocity, other analogous, technically advanced, top machinery, equipment and technology.

Broadly based cooperation, especially with the USSR, has proved to be highly effective in several areas. The question comes to mind: Would it not be possible to find a similar recipe for cooperation with the USSR and other socialist countries in the electrotechnical industry, in developing the component base, in introducing new technologies as well? It certainly would. One would only have to spend less energy on rhetoric, explanations and excuses and concentrates on deeds. For example, how long has the production sharing and specialization between the two manufacturers of television sets, Tesla Orava and Rubin Lvov, been merely spoken about...?

At the 16th CPCZ Congress and at the Fourth and Fifth CPCZ Central Committee sessions, critical remarks were made about the ministries (including the Federal Ministry of Electrotechnical Industry) and economic production units' lack of initiative in more intensively involving the sector or some factories in socialist integration, even though there is an abundance of suggestions and programs of joint interest. Those criticized may retort and prove with statistical evidence (this camouflaging maneuver is often successful) what a great range of problems they are solving within the international CEMA framework. The snag is that what is being presented as production sharing and specialization with socialist countries is often ordinary trade exchange. The subject of cooperation can also be exchange of knowledge, joint work on documentation and the like. However, what we are interested in is a higher form of cooperation. And precisely electronics is a "field that lies fallow." A field that has not been utilized for complete cooperation with CEMA member countries and the Soviet Union in particular, cooperation that would cover the entire range of the problem from research down to the production of finished goods. Why we have not been successful so far, that should provide our representatives in CEMA agencies with food for thought--representatives in the Standing Commission for Radio-Technical and Electronics Industry, in the Intergovernmental Commission for Computer Technology or in the Intergovernmental Czechoslovak-Soviet Commission for Economic and Scientific-Technical Cooperation, in which there are five permanent work groups in charge of the electrotechnical industry.

CSO: 2402/17

SYSTEM FOR AUTOMATION OF ENGINEERING WORK DESCRIBED

Sofia BULGARIAN FOREIGN TRADE in English No 6, 1981 p 30

[Article by Eng. V. Vlaeva]

[Text]

A system for the automation of engineering work is one of the latest achievements of Bulgarian computer technique. Among experts it has already become known by its Bulgarian initials as SAIT. It solves an important and topical problem in engineering and designing: the processing of graphic data. Its significance can be fully appreciated, when it is borne in mind that engraving makes up over half of the work of engineers and designers.

SAIT is a representative of dialogue and interactive systems, which constitute a new class. In comparison with the classical computer systems, which make use of digits, SAIT is based on the language of engraving. This graphic form of representation is readily perceived by man. The machine does all the routine work and shows its automated solutions on a screen, while the expert by means of a light pen can work on that solution. Man is thus included in the calculation process with his intellect and intuition. The automation of creative work turns into a dialogue 'man-machine'.

The configuration of this system consists of four autonomous subsystems: a central processor — ISOT-2100 S, with operative memory and a special processor for it, an input-output processor, and a peripheral processor. The subsystems are connected by means of an effective scheme, based on an asynchronous principle of work. Each subsystem permits a further development as regards the number of peripheral devices, thanks to which SAIT's potential — quantity of data and rapidity of processing — can be raised.

SAIT has a ready programme for the designing of plates in electronics, which closes the cycle of designing electronic elements, elaboration of technologies for two-layer and multilayer printed-circuit cards, the construction of elements on them, the drawing of photopatterns for the production of printed-circuit cards, the documentation and technical preparation of production. In all cases we mean the generation of control programmes for special technological machines in electronics with programming. SAIT was used for the first time in order to design itself, its own plates.

This system should facilitate the work of engineers and designers in construction, architecture, machinebuilding

and car manufacture. The programming of cutting material in the tailoring and metalworking industry, in shipbuilding and wherever leaf material is subject to figure processing, has already been terminated.

SAIT represents a major contribution to the solution of problems of intellectualization in all spheres of human activity.

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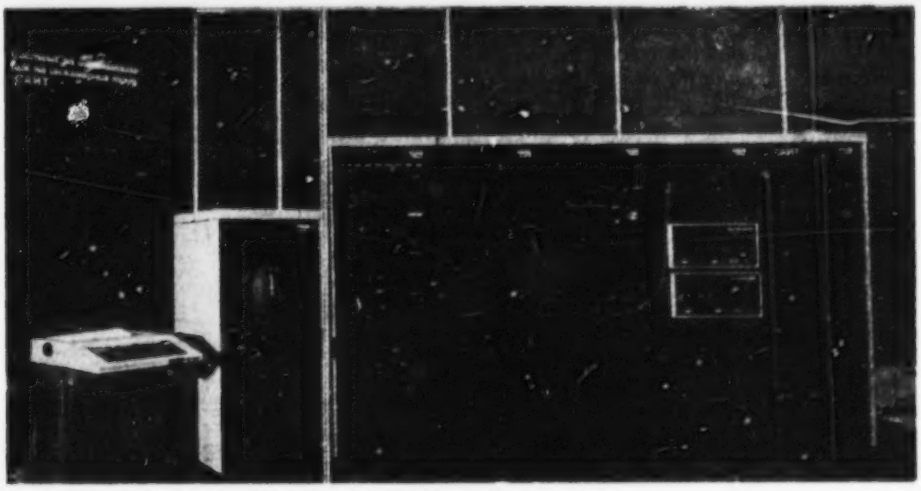
ISOTIMPEX
Foreign Trade Organization
Sofia, Bulgaria
51 Chapaev St.
Phone: 73-61
Telex: 022 731, 022 732



CSO: 2020/18

INFOREG PROBLEM-ORIENTED COMPLEX

Sofia BULGARIAN FOREIGN TRADE in English No 6, 1981 pp 30-31

[Text]

Inforeg is the name of the first problem-oriented complex in Bulgaria, based on the technical and pogramming means of computers of the SM series. Its main purpose is to automate reference data, but it can also be used as a powerful mini-calculator with universal application.

The basic functional part of the problem-oriented complex is the SM 4P processor. The complex conforms to modern requirements as regards configuration of systems. It offers a wide range of possibilities: the maximal outer memory has eight disk devices by 29 MB. Its volume is determined by the package of programmes. The structure of information on a concrete sphere of problems is organized through these programmes.

Up to 48 working places with local and long-distance switching in of the terminals can be organized by means of this complex. The data are introduced by means of a letter-number display. Inforeg performs the addition, storage, topicalization and processing of the data. It is a dialogue system and operates in conditions of time-division and collective access to the data base. As many as 64 programmes can be carried out simultaneously. The information is processed with a precision up to the 27th decimal sign.

The programmer obtains access to the system with the help of a specialized operational system and problem-oriented idiom. His work is facilitated by a set of systematic and official programmes for work with a data base. The system is protected from unauthorized access.

Inforeg can conciderably alleviate the administrative servicing of the population by creating automated card-indexes and registers. It can be used for analogous purposes in hospitals and clinics, where it makes it possible to trace the history of the disease and to rapidly diagnose it. It greatly facilitates reference services in libraries. The list of Inforeg's possible application is a long one, including among others: insurance, administrative work in schools and universities, foreign trade organizations, material and technical supply, and warehouses.

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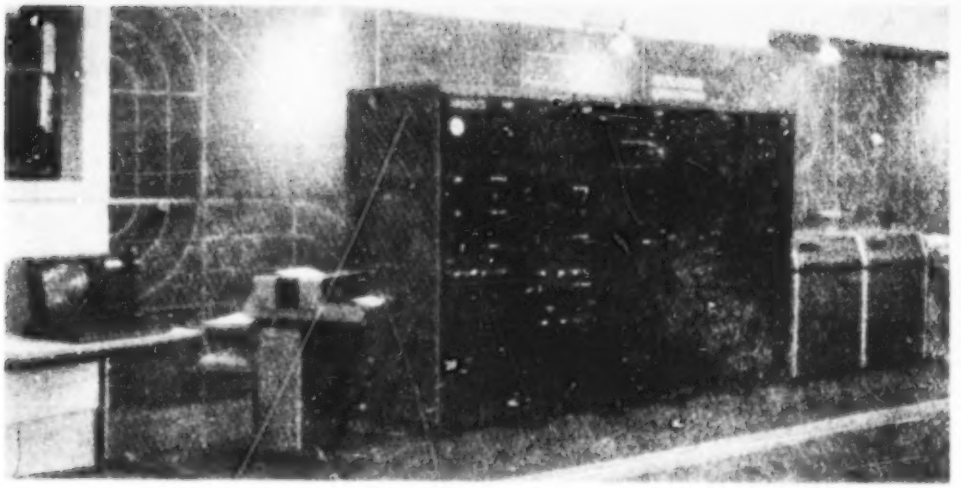

CSO: 2020/18

TEXTPROCESSING MACHINE ISOT 1002C DESCRIBED

Sofia BULGARIAN FOREIGN TRADE in English No 6, 1981 p 43

[Text] Automates type-writing and traditional editing operation in typing offices, editorial boards, printing houses. Useful for recording new articles in design and construction institutes and development bases, as well as for setting up modern ways of work in the offices of large industrial or farming enterprises. It is made on the modular principle.

Technical Features

--Control unit on the basis of an 8-bit microprocessor.

--Volume of the operative memory--48K bite.

--Display on electronic-ray pipe (tube) with display capacity of 1920 symbols.

--Standard keyboard in Latin and Cyrillics.

--Functional keyboard on the basis of the traditional language for correction and processing of texts.

--External memory unit on flexible magnetic discs ES50 74.

--Serial letter-digital printing unit ES 7187--el. power.

--Feeding 220V, 50 Hz.

Performance

--Introduction and printing of text on the external memory unit.

--Automatic formating of the text fed.

--Various corrections, inserting, replacing or removing of sentences, words or separate symbols.

--Setting up of document of standard text passages.

--Duplication of documents.

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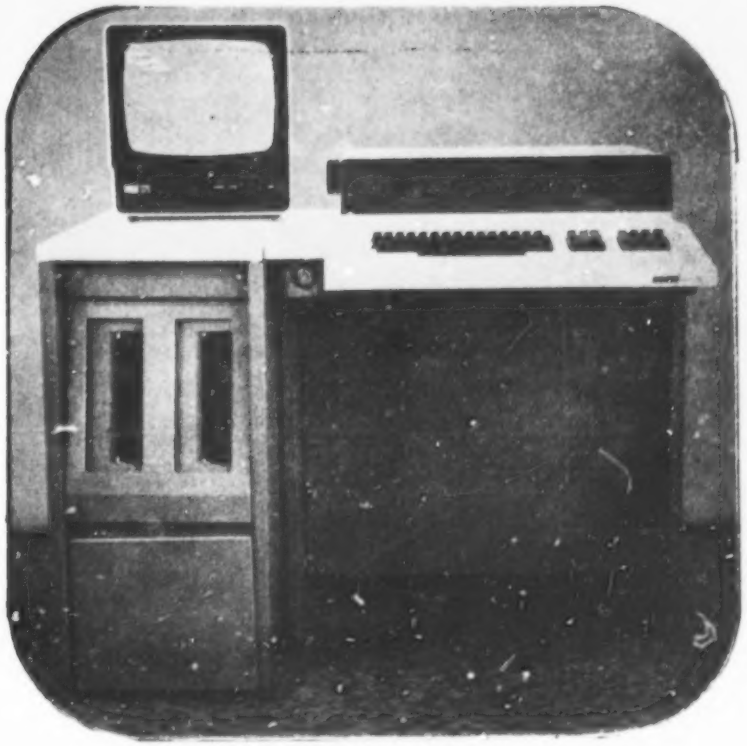

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ESK-M-400 AUTOMATIC TELEPHONE EXCHANGE DESCRIBED

Sofia BULGARIAN FOREIGN TRADE in English No 4, 1981 p 30

[Article by Eng. V. Yossifov: "ESK-M-400 Automatic Telephone Exchange With Microprocessor Control"]

[Text]

The ESK-M-400 automatic telephone exchange is designed for office telephone networks with a capacity of up to 400 interior extensions. It is a development of the ESK 400 E office branch exchange of the crosspoint type, an improved new generation of telephone exchanges, quite up to the latest requirements of communication technique.

ESK-M-400 has considerable advantages over its predecessors. It is controlled according to a new schematic solution based on microprocessors, thereby realizing a programming movement of the orders. Control by a recording programme makes it easily adaptable to various signalization systems. Integrated circuits with a high degree of integration have been used, and the model structure introduced makes for a most rational utilization of the equipment with different schedules.

Much more compact in size, the ESK-M-400 exchange has been developed at the Institute of Communication Industry and is produced by the plant for telephony and telegraphy in Sofia. It was awarded a gold medal at the 36th Plovdiv International Fair where it aroused pronounced interest, among experts and businessmen.

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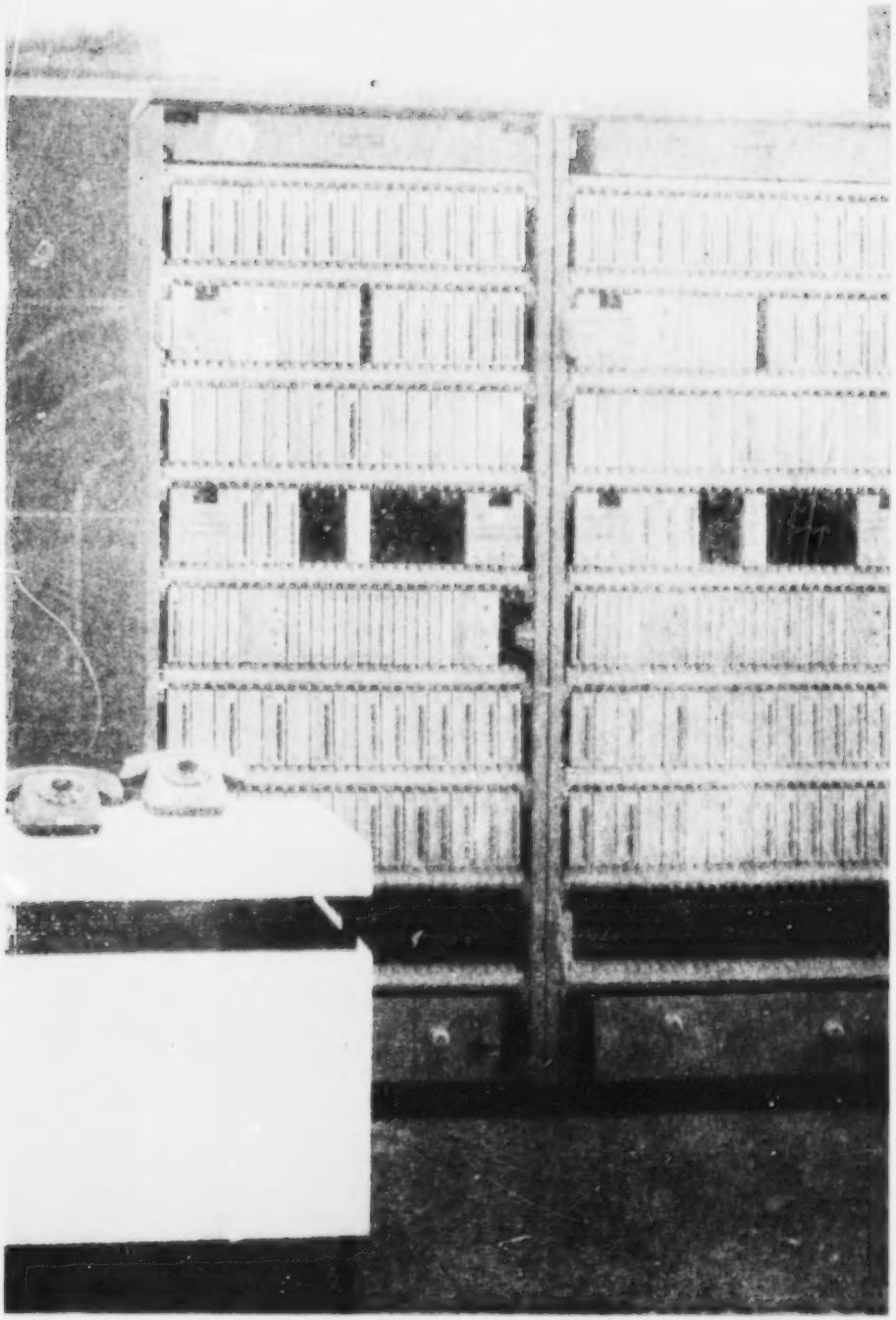

CSO: 2020/18

NEW SERIES OF MEDIUM-WAVE RADIO TRANSMITTERS

Sofia BULGARIAN FOREIGN TRADE in English No 4, 1981 p 31

[Text]

The new SB series of medium-wave radio transmitters was designed in accordance with the latest requirements: higher technical indicators, compact size, maximal reliability in operation and easy servicing.

The SB series of medium-wave radio transmitters have a rated power of carrying frequency of 1, 10, 25, 50, 100, 250 or 500 kW and a frequency range of 525 to 1,605 kHz. They have a module structure, so that they can be rapidly mounted and transported.

The application of quite new technical solutions has made it possible to produce one of the most compact radio transmitters in the world as regards of power. The SB series is made entirely of transistor elements and only one powerful end radio-lamp is used.

The new, exceedingly reliable method of lattice modulation of the carrying frequency is something quite original; it was patented and realized for the irst time in the world production of radio transmitters.

The aerials have been developed according to a new electric scheme, guaranteeing very good transmission.

The automatic regime of work, together with the other advantages, makes it possible to slash costs, as no servicing personnel is necessary.

The producer guarantees all the necessary accessories, including assemblage and putting into operation.

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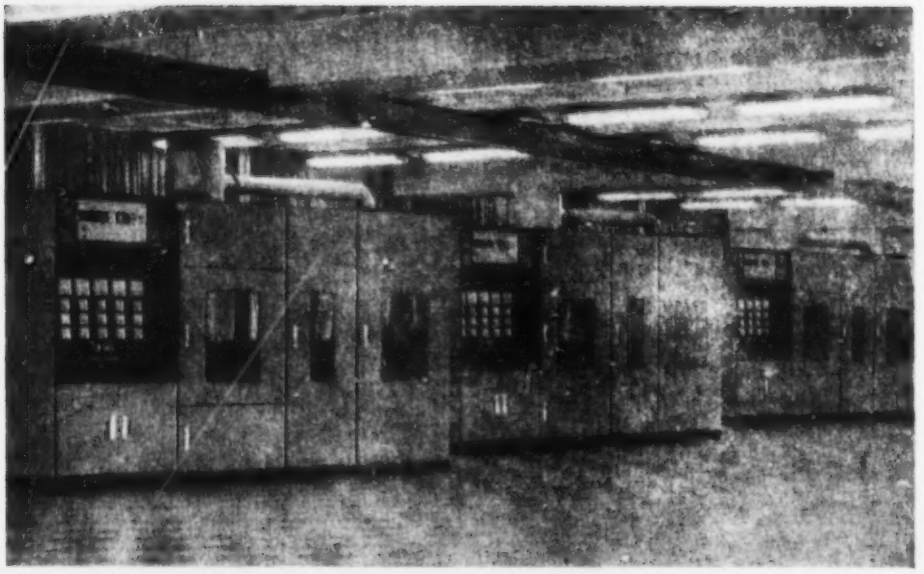
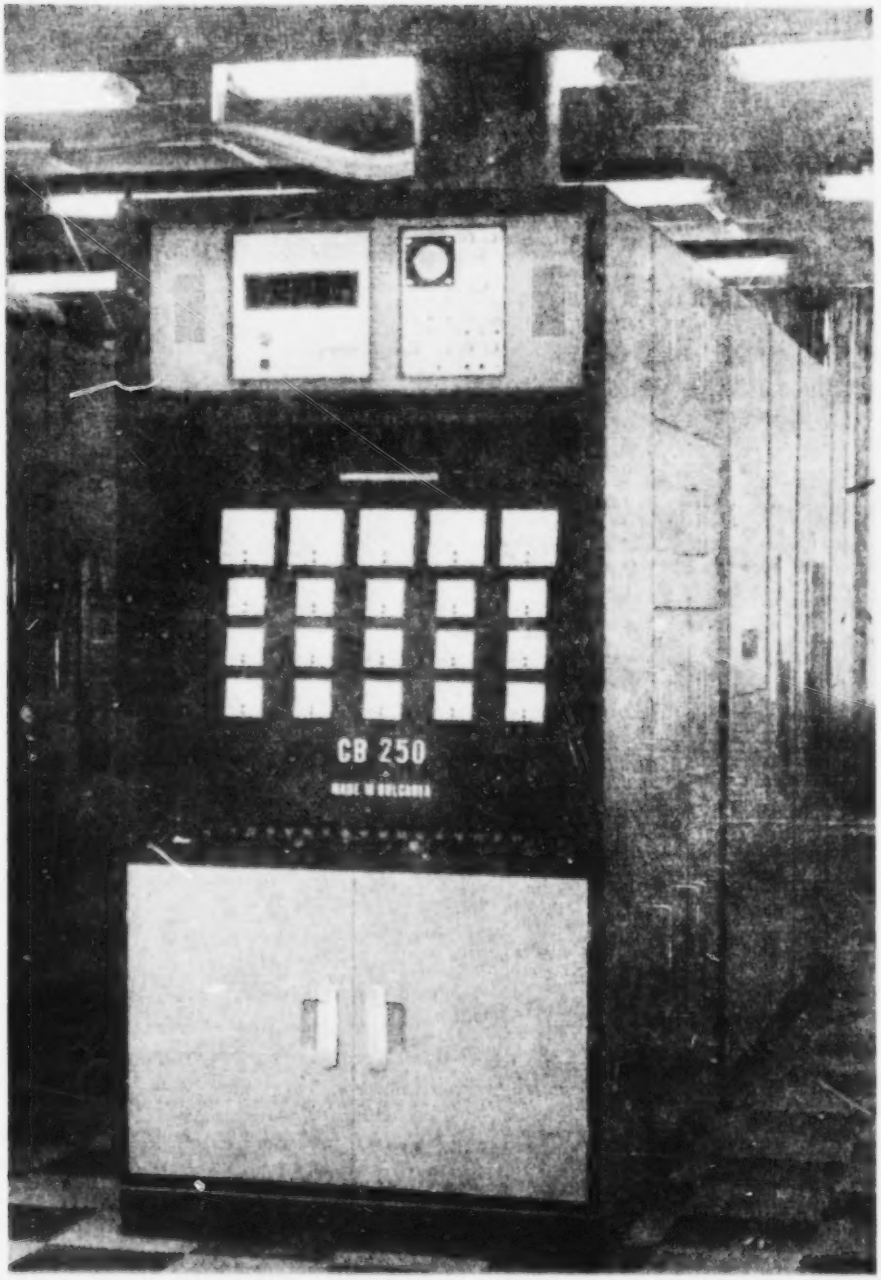




CSO: 2020/18

ELKA-90 ELECTRONIC CASH REGISTER

Sofia BULGARIAN FOREIGN TRADE in English No 4, 1981 p 32

[Text]

The ELKA-90 electronic cash register is a cash terminal offering the possibility of automatic introduction of data from labels. It is designed for small, medium-sized and department stores, restaurants, storerooms, etc.
Functional characteristics

Registers:

a) five sectional

b) five cancelling

c) seven for waiters with coding key access

d) one for introduced sums

e) one for sums taken out

f) four for various payments (cash, cheques, credit, coupons)

Each of these registers has a counter (4-digit) for recording the number of accumulations.

g) 76 article registers (8 digits) for introducing a code number
Programmed registers

a) percentage; b) data; and c) cash number.

Control counters: a four-digit counter for accounts performed, and

b) four-digit counter for cancellations.

Chief operations: accumulation, cancellation, multiplication, % plus, % minus, correction of erroneous accumulation, nullification, total, credit, cheques, coupons.

ELKA-90 has two data-introduction regimes: a manual one and an automatic one by means of a mobile label-reader.

Manual regime: a) introduction of list number up to 11 digits; b) value up to seven digits; and c) quantity up to five digits.

Automatic regime: data are introduced by a manual reader from magnetically coded labels. The maximal number of coded symbols on the label is 45 (list number up to 11 digits, price up to seven digits, additional identification signs (size, height, colour, etc.) up to 24 digits. Data on the article's price and list number which can be visually identified is entered on a paper pad.

Magnetic reader:

a) reading speed: 8÷80 cm/s

b) direction: forward and backward
c) cable length: up to 2 metres
The correctly reproduced signal is indicated by a short sound signal.

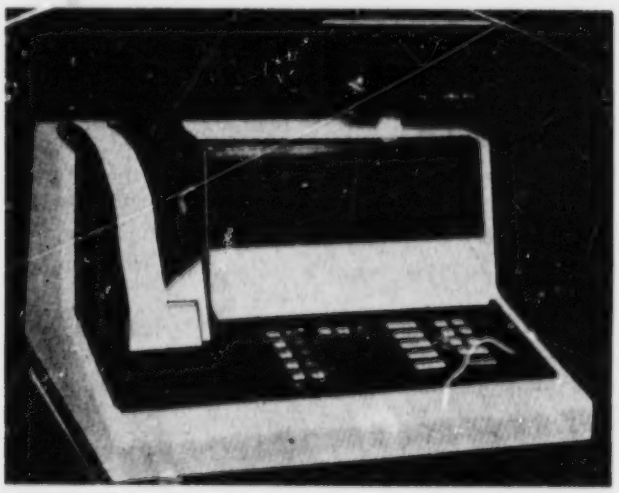
ELKA-90 has a cash terminal and two working regimes:

a) autonomous; and

b) systematic, which ensures switching by means of a four-channel interface cable into a digit taperecorder or data-concentrator with organization of circular connection.

Every sale registered on ELKA-90 is accompanied by a slip with data on the price, the article's amount and list number, the cash box number, the type of operation, additional identification signs introduced by the reader on labels and control symbols.

Exporter:
ISOTIMPEX
Foreign Trade Organization
Sofia, Bulgaria
51 Chapaev St.
Phone: 73-61
Telex: 022 731, 022 732



CSO: 2020/18

JOINT USSR, BULGARIAN SYSTEM SHOWN

Sofia BULGARIAN FOREIGN TRADE in English No 5, 1981 p 6

The highly accurate ES 1035 electronic system, a joint design of Bulgarian and Soviet experts.

CSO: 2020/18

AUTOMATION OF PRODUCTION, ROBOTIZED COMPLEXES

Sofia BULGARIAN FOREIGN TRADE in English No 5, 1981 pp 22-23

[Article by Eng. V. Vuzelov: "Automation of Production Through Manipulators and Robotized Complexes"]

[Text]

The development and production of industrial manipulators and robots, as well as of transport-feeding equipment and systems connected with their application, began in Bulgaria in 1970. In a mere decade the transport-feeding systems which come in various combinations have been finding wide employment in different spheres of industry, especially in engineering. The wide range of robots, manipulators and devices offer good opportunities for devising various technological solutions. Re-attunable automatic lines have been developed, which include processing machines, feeding manipulators of the PIRIN family, roller belt conveyors and other equipment serving a variety of purposes. These lines are used in the machining of semiaxles for electric trucks, graded shafts for metalworking machines and shafts for electric motors. Lines for the mechanical treatment of piston rods of hydrocylinders are made, as well as plungers weighing up to 70 kgf for shafts of telfer electric motors, for shafts and gear wheels of reductors, for rope and chain drums of telfers. The experience gained in the manufacture of these types of robotized complexes and the good technical indicators of the manipulators and transport-feeding devices produced have aroused interest among Machinoexport's foreign trade partners. Automated lines with a re-attunable cycle are being built in the KAMAZ plants in the Soviet Union with Bulgarian manipulators and belt conveyors. Two lines for the treatment of belt conveyor axles are now in operation in the GDR, and others for the treatment of electric motor shafts are now being made. One of them will be used for the complete mechanical treatment of shaft rotors, weighing up to 60 kgf, and the other for the treatment of chuck details up to 250 mm in dia. Similar lines are planned for Poland as well, and Bulgarian standing manipulators are now in use in the ROTA-200 machine system in Czechoslovakia.

Manipulators of the series with a loading capacity of 120 and 160 kgf or so-called 'heavy manipulators' are used in automatic lines or complexes of machines for the manipulation of heavy rotation details such as shafts, rotors and drums. These are stable in structure and come as portal up to 15 m. long. Supports range in number from two to four. The drive is hydraulic and is effected by individual standardized hydroaggregates. The maximal speed of the mobile parts is

0.4 m/sec. and the max. run of the 'hands' is 800 mm. A special modification of this type of manipulators is the model with an electromechanical drive.

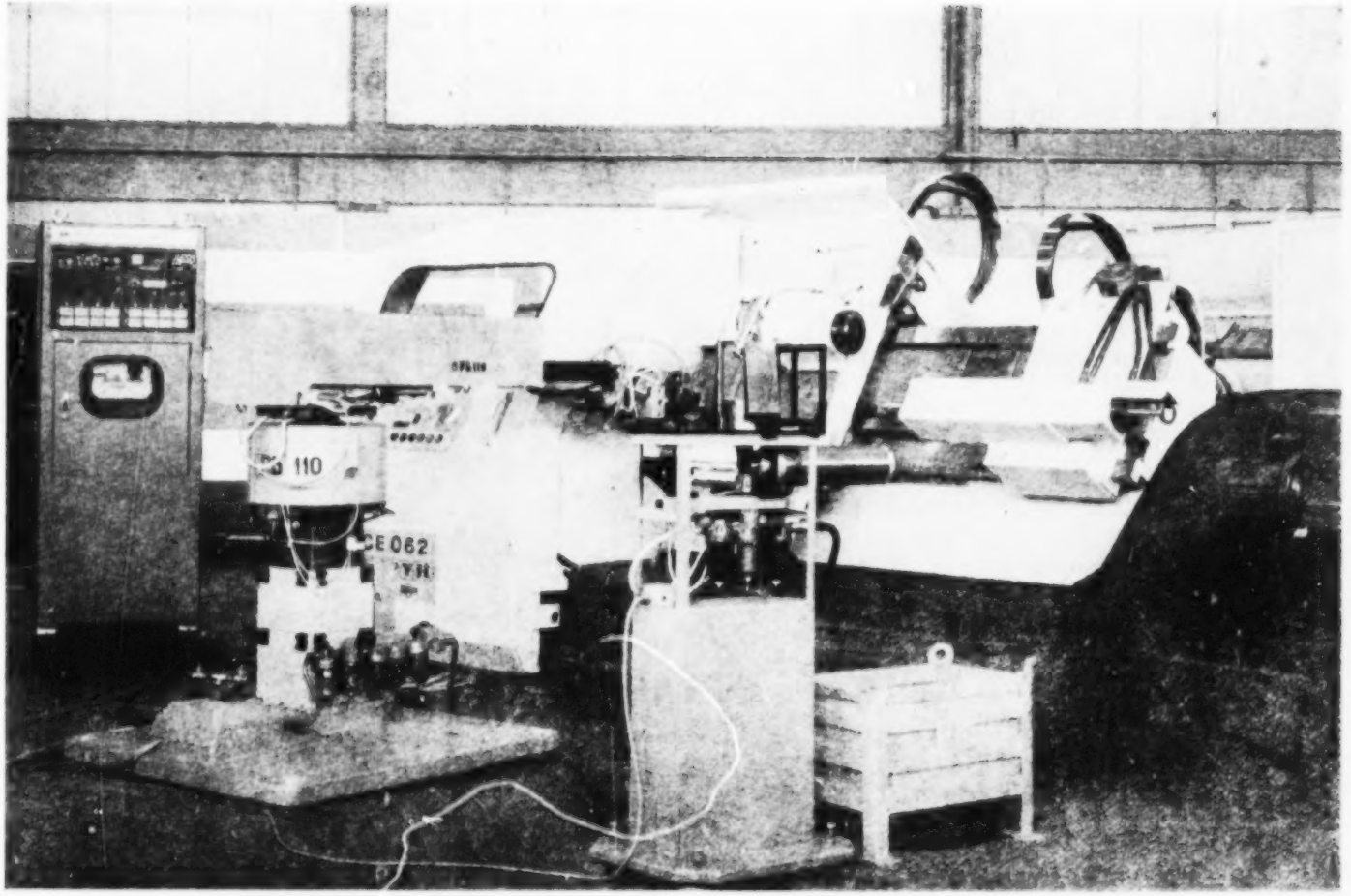
Another group of PIRIN manipulators are the so-called 'standing manipulators' of the 521 series. They are placed on a stand so that they can be mounted on the floor of the production premise in front or behind the servicing machine. The details are replaced on these machines by two horizontal mechanical hands located opposite to one another. The design of the hand and the hydrodrive have been standardized to a considerable degree with those of portal manipulators. Depending on the number and sequence of the movements performed, these manipulators come in four modifications, the number of the degrees of freedom of the mechanical hands attaining five. The time required for re-attunement is five minutes. This makes it possible to apply them effectively when servicing machines with digit programming. The replacement of the details takes from 8 to 14 seconds. The load capacity of each hand at a maximal speed of the different movements is 20 kgf payload. Manipulators of this family are in batch production in Bulgaria and are used chiefly in the ROTA F-200 machine systems made in the German Democratic Republic; they are also used, however, in the automation of different working places or production cells.

Bracket manipulators are a modification of portal manipulators. In them the feeding and the unloading hands are located on one side of the carrier beam.

Besides the manipulators listed above, MACHINOEXPORT is in a position to supply its partners with industrial robots for different types of other technological processes: coating, stamping, forging and welding. Among these, let us mention the BEROE-210 spraying model for coating and the industrial robots RB-231, RB-232, RB-233, RB-234 and FB, made after a licence of the American Versatran Co. These, too, are based on the module principle with separate movements; depending on the particular requirements, they come in different spatial positions: supporting, suspended or portal with possibilities of being entirely shifted to the manipulating block. The working organs have a specific configuration, depending on the functional purpose they are to serve. All the movements are with individual servo- or mechanical control.

The experience gained in the designing, manufacture and delivery of automated robotized complexes and the wide range of products (manipulators, robots and complementary peripheral devices) enable MACHINOEXPORT to offer everyone of its customers the technologically and economically best solution of problems involving robotization and flexible automation.

Widely applied in machinebuilding are the Beroe robots of the RB series as well as the different varieties of manipulators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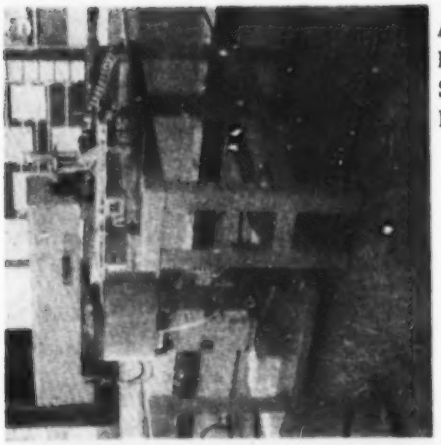
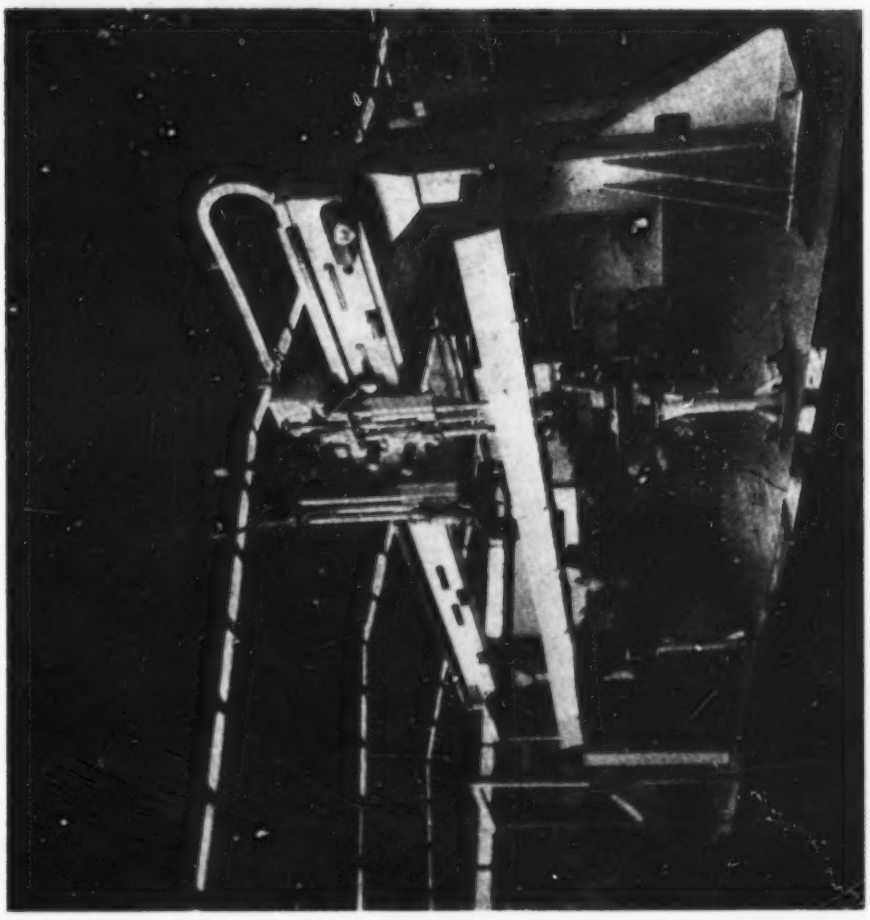


Address:
MACHINOEXPORT
Sofia, 5 Aksakov St.
Phone: 88-53-51



CSO: 2020/18

'RUDE PRAVO' ON DEFICIENCIES IN COMPUTER POLICY

AU221502 Prague RUDE PRAVO in Czech 21 Dec 81 p 5

[Article by Eng Jindrich Katscher from the "Computer and Organization Service" Enterprise in Prague: "Less Would Mean More; the Experience and Views of a Computer Technology User"]

[Excerpts] Jan Obrhel, director of the "Office Machinery Enterprise" in Prague recently drew attention in the press to several serious shortcomings in the use of computer technology--particularly to the fact that we are using various types of computers that are not mutually compatible, that the means invested in computer technology have not found the appropriate valorization [zhodnoceni] in the international division of labor, and that our enterprises' production of computer technology is commensurate neither with the domestic nor with the export needs. J. Obrhel sees the reason for this in the fact that the planning authorities give preference, as far as this type of merchandise is concerned, to quantity over quality. He correctly notes that a smaller number of well-functioning computers would contribute more to the national economy than a large number of inadequately working and incomplete installations.

The causes of this state of affairs are historical and originate in ill-considered innovation drives, in the underestimation of the importance of production traditions, in insufficient cooperation--bordering on rivalry--between research, development, production, service and user organizations, and so forth.

The advent of international cooperation, characterized by a gradual implementation of the United System of Electronic Computers (JSEP), has produced another shortcoming. In the absolutely poorly-thought-out attempt to inplant as much labor as possible into a minimum of material, we have been gradually getting rid of the production of peripheral equipment such as magnetic tape and disk memories, equipment for preparing and collecting data, and so forth. When we today produce such equipment at all, the production is not large enough to effect even the most essential exports, let alone to cover domestic needs. We have reduced the computer technology production sector virtually to the production of processors, that is to the computers' central units. While doing so we did not consider that processors without peripheral equipment and materials enabling operation are incapable of proper functioning.

Because the production start-up of the JSEP computers has been delayed and the import from capitalist countries limited, many enterprises began--without coordinating their activities--to develop or produce various types of fundamentally diverse processors. One could list types such as EC1025, EC1027, ADT 4300, ADT 4500, RPP 16, JPR-6, JPR-12, TP 8, KA 10, SM3-20, SM4-20, SM50/40, SM 50/50 and others. The production or supply of a sufficient quantity of peripheral equipment has been ensured for none of these processors. Every producer is trying to obtain this equipment by limiting or discontinuing the production of other types. Moreover, virtually none of these processors can be exported in large series because almost every CEMA country has access to equivalent or even better types of processors and peripheral equipment from its own production.

The greatest claim for priority allocation of peripheral equipment is currently being voiced by the producers of the SM3-20 and SM4-20 processors. Even though these have been included in the CEMA countries' System of Small Electronic Computers (SMEPO, I do not think that this claim is acceptable. The types concerned are, in fact, transitory models which--even though their production is only starting--should be withdrawn from production in the course of the seventh 5-year plan [by 1985]. They will be replaced by SM50/40 and SM 50/50 minicomputers, based on domestically produced microprocessors.

In my opinion, it would be highly expedient and economical to halt the development and production of the SM3-20 and SM4-20 processors. The resources and manpower thus released could then be concentrated on ensuring the development and production of the SM 50/40 and SM 50/50 computers, including modern peripheral equipment and problem-oriented program modules.

I agree with J. Obrhel's view that it is not expedient when the user organizations ensure the computers' maintenance. This service should be ensured by the National Organization of Technical Maintenance (NOTO). Nevertheless, here, too, it is necessary to carefully weigh one's approach.

First of all, the user must be certain that the operation of the computer system he entrusts to the care of the service organization will be reliable. So far, he does not have this certainty. Computers of the JSEP, SMEP and other systems require constant technical and operational supervision, an air-conditioned environment and an extensive team of programmers and operators.

As far as foreign computers are concerned, the situation is different. They can work anywhere in an office environment and the user can program, operate and maintain his computer himself, with the help of well-organized service organizations. These service organizations monitor and test the operational readiness of the equipment and programs under their supervision from their headquarters, by means of telephone lines. The technician appears in person only when telephone instructions are not enough or when the breakdown is of a more serious nature.

It would be commendable to ensure similar operational conditions for computers in the CSSR. Because the path toward achieving this goal is still long, it should be enshrined in the branches' and sectors' long-term concepts.

CSO: 2402/18

ELECTRONICS INDUSTRY CENTRALIZED, STREAMLINED

Budapest NEPSZABADSAG in Hungarian 5 Jan 81 p 5

[Excerpts] Last December, the Council of Ministers enacted a resolution on the central development program for electronic parts and components. This long-awaited, important decision specifies the main agenda and the areas of development for the next 10 years.

Although the domestic electronics industry has valuable traditions, it has fallen behind the European state of the art over the past decades. Less than necessary has been spent on expanding production of electronic parts; consequently, closing the gap has become vital for industry and the entire economy. Those who prepared the recently accepted program began with the premise that we are not as badly off as many believe in regard to the production and metering equipment needed for fabricating microelectronic parts. A good deal of such equipment can be found at various research institutes and what is lacking can be obtained from the USSR and the socialist countries. The electronics industry is exceptionally developed in the Soviet Union and capable of producing practically anything made by the West. Taking over Soviet technology, adapting their equipment will undoubtedly require much study, preparation and research-development. However, Hungarian engineers have acquired this expertise over the past years and learned what is necessary to fabricate LSIs [Large Scale Integrated Circuits].

In 1976 two Academy research institutes and two industrial enterprises, collaborating with United Incandescent, formed an association for IC research and development. Nearly 600 million forints were spent on specialized training and the evolution of new devices and procedures. Six types of LSIs were developed and their trial production begun. Several new solutions were found and production devices were designed including a microelectronics metering automat.

Up to the present, the leading experts have been working under the direction of several portfolios and in accord with the ideas and needs of various enterprises. Under the program now adopted, specialists from the HIKI [Communications Engineering Industrial Research Institute], the Central Physics Research Institute, United Incandescent, TAKI [Telecommunications Research Institute], the Technical Physics Research Institute and SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences] will all work under single direction. The technological equipment will be moved to HIKI where there is space and room for expansion.

Insofar as what to produce is concerned, it has been decided to establish design systems and satisfy Hungary's special requirements. Cheap, mass-produced circuits will be purchased abroad. This decision was arrived at after the Communications Engineering Association ordered special, so-called equipment-oriented, circuits from the USA. Such circuits have to be individually designed for the equipment and are capable of performing exceptionally complex tasks. The first 200 such circuits cost 80,000 dollars; each additional circuit was offered for 5 dollars. According to the members of the Association, this proves that the intellectual input is very highly paid for in the field of microcircuitry. From this the Association concluded that we, whose intellectual expertise greatly surpasses the capabilities of our background industry, should not expect profits from serially produced 5 dollar circuits but from those equivalent to the first 200 which cost 80,000 dollars. It is preferable for us to produce fewer but far more valuable circuitry for our own enterprises which make electronic equipment and for our foreign business partners. Our concept links fabrication of electronic components to manufacture of production equipment. Consequently our central development program for electronic parts and components will be based on achievements of the Soviet Union and the socialist countries and our intellectrual resources will be united. To achieve this, we are establishing an autonomous unit to be named the Microelectronics Enterprise. During the 10 years projected for implementing the program the structure for parts and component production will be entirely reorganized to make our production of electronic apparatus more competitive. Preliminary calculations indicate that implementation of the program and reorganization can be achieved for less than the 6 billion forints estimated in previous studies.

CSO: 2502/33

BRIEFS

MERGER OF COMPUTER OUTFITS--As of January 1982 three computer technology organizations were merged into a single, complex development type enterprise. The action was based on the position taken by the Science Policy Committee and the decision of the Central Statistical Bureau. To be known as SZAMALK [Szamitastechnika Alkalmazasi Vallalat, Computer Technology Applications Enterprise] the enterprise will incorporate SZAMKI [Szamitastechnika Alkalmazasi Kutato Intezet, Computer Technology Applications Research Institute], OSZV [Orszagos Szamitogeptechnikai Vallalat, National Computer Technology Enterprise] and SZAMOK [Szamitastechnikai Oktato Kozpont, Computer Technology Training Center] all of which have been disbanded. Establishment of the new enterprise will concentrate forces, promote implementation of the central development program for computer technology and improve the efficiency for R & D. SZAMALK will be located in four buildings in various parts of Budapest. The Managing Directorate will be located at 68 Arpad Szakasits Rd, the R & D Directorate at 30-32 Csalogany Street, the Service and Commercial Directorate at 6 Vahot Street and 104 Bela Bartok Street. [Budapest MAGYAR NEMZET in Hungarian 4 Jan 82 p 3]

CSO: 2502/34

END

JPRS 80183

25 February 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 732

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JPRS 80183

25 February 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 732

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BRIEFS

ELECTRONICS PRODUCTION INCREASING--In 1982, CSSR electronics and communications industry production is to rise 8.2 percent, with the production of microelectronic circuits rising 22 percent, control and measurement instruments 10 percent and medical technology 9 percent. Exports to socialist countries will increase more than 10 percent and to other countries almost 16 percent. [Prague ZEMEDELSKE NOVINY in Czech 11 Feb 82 p 6]

CHEMICAL TRAINING IN JAPAN--Currently, about 8,000 tons of acrylate dispersions are produced yearly at the Chemical Works in Sokolov. During the Seventh Five-Year Plan [1981-1985], this production is to increase 3-fold. In order to cope with this task, 45 workers have been selected for further training. After 6 months of language courses, 3 months of practical experience at large chemical plants, mainly at the Zaluzi near Most and Bratislava plants, will follow. Then half of these trainees, selected for positions of shift foremen, production sector chiefs, etc, will receive 3 months of training in Japan. [Prague MLADA FRONTA in Czech 4 Feb 82 p 7]

CSO: 2402/25

DECREE ON REORGANIZATION OF RESEARCH INSTITUTES PUBLISHED

Budapest IPARI KOZLONY in Hunsarian 3 Dec 81 pp 552-554

[Article by Lenard Pal: "Decree of the Secretary General of the Hungarian Academy of Sciences on the Introduction of More Open and Flexible Operations Structures of the Research Institutes"]

[Text] 1. International experience shows that the network of research institutes is continuously modernized corresponding to the actual nature of research work. Research and development shops have--according to the research-task goals and the nature of research--many organizational structures (research centers, research institutes, universities, research development companies, etc); creative work processes also as a function of the methods used, in a differentiated framework. Also in our country, it is necessary--in the interest of increasing the effectiveness of scientific research--to introduce and popularize new, more open and more flexible organizational structures and application methods allowing a better utilization of scientific potentials. These structures must serve comprehensive and successful implementation of principal research targets, programs, priority tasks, promote the use of multidisciplinary approaches and allow a better concentration of researchers working in different institutes but involved in the same task in a collective effort to achieve priority goals.

2. The nucleus of the new flixible organizational structures is already present in the organizational system of the Hunsarian research network. The research institutes are justified in the future--especially in view of the economic circumstances and requirements--to place greater emphasis on the extension of the guest-researcher and outside-colleague system, in whose framework, experts may be employed for a given length of time.

There may be numerous reasons, depending on the nature of research activities, for the admission of guest researchers, outside colleagues:

2.1 To increase its diversification, speed and effectiveness, it may become necessary for a research facility to admit in a systematic manner, in a given area, for a given length of time the best outside experts of a specific field for a given task (e.g., national and board-level research goals, programs and other priority tasks).

2.2 Modern and highly-equipped institutes with special laboratories may permit outside experts to perform tasks necessitating modern and highly-equipped the institutes and special laboratories.

2.3 Research institutes may employ a relatively large number of young experts for a given length of time to acquaint them with research methods and involve them with research work (this function may serve postgraduate and researcher training).

2.4 Institutes with good research conditions can provide guest researchers and outside colleagues with favorable creative atmosphere, undisturbed conditions, quiet circumstances to perform a given research work.

2.5 Various temporary and multidisciplinary research associations, plants and cooperatives, etc, set up for the performance of a given task and dissolved after the completion of the task may also strive for the expansion of the employment of guest researchers and outside colleagues.

3. Parallel to the expansion of the guest-researcher and outside-colleague system, the cooperation between research institutes and cooperatives must be stregthened with special regard to the introduction of completed research results, licenses and know-how. The ties between research institutes and educational institutions must be increased; the role of scientific associations in the development of new ties and operating methods must be enhanced.

3.1 The so-called cooperation agreements or company contracts, and sometimes research and development associations, provide a good framework for the cooperation of research institutes and cooperatives.

3.2 The ties between research institutes and educational institutions may be strengthened by united research organizations, academic departments, cooperatives, the organizations for common professional courses and the common use of experimental plants, instrument facilities, etc.

3.3 The disciplinary research and development associations, applied social sciences analysis plants, methodology centers, etc may be regarded as new-type organizations to be supported in the social sciences.

4. In the interest of further increasing of the level of scientific work, in addition to the existing organizational structures, it is justifiable to develop the framework-institute structure. In this period of intensive social and scientific development, thanks to the opportunities offered by the framework institutes, the existing and potential forces of research may be used on one hand more effectively, and on the other hand, as a result of their use, the number of creative professionals can increase.

4.1 By framework institutes, we mean that organizational and operational structure of already existing main-charter research institutes which perform their tasks with the assistance of a smaller proportion of permanent researchers and a larger proportion of temporary researchers of the total authorized number of researchers: according to this, for a given time period, they employ guest researchers or outside colleagues, based on invitations or contests. In a framework research institute, it is best to develop the proportion of permanent and temporary research personnel gradually.

4.2 The framework institute structure may be equally suitable for the fuller realization of national research potentials in the area of social, technical, agricultural, medical and natural sciences.

Institutes that are involved in priority research tasks with significant capacities and conduct multidisciplinary research may function as framework institutes. Institutes that based on their conditions are attractive to professionals showing research inclination and ability and employed in research institutes without a main charter can also function as framework institutes. A science school or special instruments, the opportunity to acquire modern research methods and technologies, etc, can be of this nature. Occasionally, some circumstances (e.g., the proximity to Lake Balaton) may serve as a basis for the realization of the framework-institute status.

4.3 As far as possible, the permanent staff of the framework institutes should be made up of experienced and recognized researchers and personnel capable of satisfying local research requirements (machines, instruments, computer centers, information supply).

Guest researchers and outside colleagues should preferable be selected from two sources:

--from the circle of research- and development-type experts and non-research- and development-type practical experts.

--from the circle of university (college) educational researchers partially or fully exempted of educational duties, who can take advantage of the capacity of the frame institute for the realization of a concrete task.

Occasionally, personnel of other work situations can also be considered who, for instance, accept assignments in framework institutes to perform an attractive task, or if their employer considers their assignment in a framework institute useful.

The framework institute will offer employment to the guest researcher and outside colleague from 3 months to 3 years, which can be extended in exceptional cases to a maximum of 5 years.

4.4 During the period of employment in a framework institute, the original work relation of the guest researchers and outside colleagues is not terminated. Their salary is covered in the following manner:

--the institutes charge against their own salary budget the salary of the guest researchers and outside colleagues for a given period of time, based on their original employer's assignment.

--or the original employer pays the guest researchers and outside colleagues and sends them to the framework institutes for job assignments.

A combination of the above two methods may also be justifiable to make selection as broad as possible and allow the most research-qualified personnel join the framework institutes. In both cases, the final decision in the selection of the person is made by the framework institute.

In the case of an assignment, an agreement dealing with employer rights and obligations toward the employee must be made between the framework institute and the original employer. The agreement must regulate the length of the assignment, the location of the job, tasks, salary, allowances and compensations, etc. The employer's rights are determined by the director of the receiving institute, except for the termination of the work relation.

In the case of an assignment exceeding 3 months, the agreement of the employee must also be secured taking into account labor regulations.

4.5 In the framework institute, the basic activity--as far as this can be established--will be institute-financed or task-financed, and the varying tasks--if possible--task-financed.

4.5.1 The institutes will mostly cover their framework-institute-related functions from their own financial means. If the framework institute is reimbursed by the organization sending the guest researcher or outside colleague, the income accrued can be used by the framework institute for scientific goals, in accordance with the appropriate rules.

4.5.2 The supervisory organs will support the functions of the framework institutes even financially and provide from their own reserves additional financial sources to the framework organizations. Those researchers successfully performing as guest researchers or outside colleagues in framework institutes should be morally and materially recognized.

4.5.3 In case a guest researcher, outside colleague finds employment away from his residence in a framework institute, his extra expenses (room and board) must be covered from the domestic research-trip funds.

4.5.4 It must be achieved that the guest researcher, outside colleague is not placed in a financially disadvantageous situation (in his personal income) relative to a similar-quality permanent researcher of the institute, and if he returns to his original employer, his higher qualifications must be appropriately rewarded.

5. To promote the application of guest researchers and outside colleagues and facilitate their admittance, the institutes will disclose and point out those research opportunities and work situations which may be applicable to the workers of various institutions interested in research work. Thus, to the required degree, they will publicize their research tasks, programs the opportunities of creative scientific work (library, instruments, publishing, international relations, etc). The directors of the framework institutes should take liberal advantage of the opportunity to invite guest researchers, outside colleagues and call contests for the employment of experts to perform the research of an important subject.

CSO: 2502/35

HUNGARIAN GENETIC ENGINEERS SYNTHESIZE VASOPRESSIN GENE

Budapest NEPSZABADSAG in Hungarian 15 Jan 82 p 5

[Report on interview with Dr Csaba Kari, physician, Dr Andras Simoncsits, chemist and Imre Cserpan, chemist; Institute of Genetics, Biology Center of Szeged, by an unidentified reporter of the newspaper: "Results by Three Young Researchers From a Young Research Institute"; date of interview not given]

[Excerpt] Last year, on a dark, late-November morning, three young men bent excitedly over a newly developed film in one of the laboratories of the Genetic Institute at the Biology Center of Szeged (SZBK). The large film meant nothing to the uninitiated: it contained parallel, long and shorter, dark and even darker bands. However, after some measurements and calculations, the three men could view this film as a trophy. This last control test also confirmed the fruitfulness of their work. And during the "SZBK Days," the scientific lecture series starting on that same day--the 26th of November--they could discuss not merely their research but also their success.

The first gene synthesis in Hungary had been carried out by Dr Andras Simoncsits, Imre Cserpan and Dr Csaba Kari. Only five countries could boast with such an achievement before, the Soviet Union being the only socialist country among them.

A few days after the successful report, I sat with them in one of the SZBK offices. However, before reporting our conversation on how these three--whose combined age is less than a hundred years--achieved this result in one of the youngest research institutes of the nation, some scientific background has to be reviewed....

Dr Csaba Kari, the head of the group, is a 39 year old physician, the 32 year old Dr Andras Simoncsits and the 25 year old Imre Cserpan--who received his diploma the same year--are chemists.

[Question] Why did you start the research on gene synthesis?

[Answer] Because, in the near future, this will become an indispensable method in modern molecular biological research. Otherwise our work is closely associated with a scientific "hit tune" of recent years, with the research trend referred to as genetic engineering which has been conducted successfully for several years at the SZBK. Thus, these scientific studies can also be brought considerably more up to date.

The gene, which was produced by the researchers at Szeged after a surprisingly short investigation period, controls the production of the protein, vasopressin (VP), by the human organism. VP is produced by the pituitary. Its function is illuminated by our knowledge of the events associated with damage to the pituitary, caused by accident or disease, when VP production ceases or is reduced. One becomes ill, the main symptom being a tremendously large daily fluid excretion which can reach as much as 25 liters! Such patients need vasopresin therapy for the rest of their lives.

Luck but No Accident

[Question] Why did you choose precisely VP-gene synthesis for your research?

[Answer by Dr S.] We decided on VP gene production after considerable study and evaluation. Our primary consideration was that the VP gene has not been previously synthesized anywhere. Of course, one of the prerequisites for our work was that the amino acid sequence of VP is known and thus we could write the nucleotide sequence of the coding gene. At the same time, it was to our advantage that the VP molecule--consisting of nine amino acids--is short enough to make synthesis of its gene a realistic goal on the one hand, and, on the other hand, it is long enough to require using all of the techniques necessary for gene synthesis for its production. We thought that this may serve as a good basis for making the synthesis of longer genes a realistic goal in the future.

Of course, the history of the success achieved in less than a year dates back somewhat further. It began--and without it they could not have done it--with five years of nucleotide research by Dr Simoncsits. After that, in 1977, he went to Cambridge, England on a one-year grant where he worked in the group of Frederick Sanger who received his second Nobel prize shortly thereafter. During this time, a completely new method had been worked out by Dr Simoncsits jointly with a colleague. To determine the sequence of nucleotides, the basic units of nucleic acids, this method had been adopted by researchers very rapidly and is still being used world-wide.

On his return, he again worked with nucleotides. At about this time came the scientific report that the gene of human insulin had been synthesized in the USA.

[Answer by Dr K.] After a thorough study of this report, I asked Andras to set up the chemical DNA synthesis which he accepted willingly. We could think of this only because one of the basic requirements of setting up a chemical DNA synthesis is familiarity with nucleotide chemistry as well as with the sequencing of the nucleotide components of nucleic acid. Because he already had sufficient experience in both areas, we thought that we had a realistic basis for him to start the new work. Our recommendation was immediately accepted by the director of our institute and he gave us maximal moral and material support. Therefore, we can say that we were lucky but this luck was not entirely accidental.

After the necessary preparations, the research in DNA synthesis was started by Dr Simoncsits in the fall of 1980. In the first phase, he synthesized more than 20 modified derivatives of the four basic units of DNA. Subsequently, these had to be combined in such a manner as to follow each other in the correct sequence. Within

about half a year, he succeeded in synthesizing a DNA section consisting of 12 nucleotides. After this, they started the VP gene synthesis but by then the work was considerably accelerated.

[Answer by Dr S.] An additional factor was that, in early September, Imre Cserpan joined us as central assistant appointed by the secretary general of the Academy. He can also consider himself lucky. This was his first job and immediately he could be a participant in the first Hungarian gene synthesis.

[Answer by Dr K.] Again, this also is not an accident. Because our young colleague had worked at the Enzymological Institute of the SZBK already during his student years where he got very good training for research. It is also important that he knew English well because this is indispensable today for keeping abreast of the professional literature. He made a valued contribution to solving the problem.

The VP gene synthesis was begun by producing six DNA segments consisting of 12-15 nucleotides. This required about 150 chemical steps, carried out by Dr Simoncsits and Imre Csepan, because it is a work for chemists. By coupling the segments--which is the result of Dr Kari's work--the VP gene was finally formed. This was labelled with radioactive phosphorus. Its radiation--by producing the black band at the correct location of the film already mentioned in the introduction--revealed that the work had been successfully completed.

What Next?

[Answer by Dr K.] Here we will have to separate the further fate of the gene from our later work. Namely, further work with the gene is no longer our task. It will have to be transferred to the other side of the corridor where a group very experienced in gene splicing will incorporate it into a bacterium in such a manner that the bacterium should express it, that is, produce the VP. This is no small task just as it is no small task to obtain in completely pure form the VP synthesized in the bacterium. This in turn will be the task of the Enzymology Institute which is engaged in protein chemistry. In addition, the gene can also be used to determine the as yet unknown site of the VP gene in the human chromosome by the Somatic Cell Genetric Group of the Genetics Institute.

[Answer by Dr S.] Our future work will also be to attempt the synthesis of larger genes as well as to syntehsize the so-called "regulator" DNA segments which guide the expression of the individual genes. This is extremely important for basic research.

However, in addition to basic research, they also undertake practical tasks. The Pharmaceutical Works of Kobanya has been interested in their work from the beginning and has also provided material support. The Reanal Fine Chemical Works wishes to market the basic chemicals needed for gene synthesis. (These are currently marketed by only a single company in the world!) The Institute of Pharmaceutical Research requested special DNA segments for the gene splicing work conducted there. In addition, all three institutes wish to introduce the method and the necessary training of specialists was also accepted by the group in Szeged. This leads us far, however.

It is not the first time that the Biological Center of Szeged has produced significant results which increase its prestige and thereby the prestige of Hungarian science.

2473
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DETAILS OF MICROELECTRONICS PROGRAM PUBLISHED

Budapest FIGYELO in Hungarian 20 Jan 82 pp 1, 7

[Article by Breitner: "Run to Stay in Place"]

[Text] The Hungarian electronics industry appeared to be just about cursed. While the important profession and the large number of interested people continued to savor with jealousy the news from abroad concerning the advance of microelectronics, domesitcally the well-informed only talked about bitter arguments, in-progress proposals, rejected concepts and indecision.

Last year, on 23 December, as a Christmas present for the profession, the new government decision was finally made, establishing for the next 10 years the task of the microelectronics component manufacturing and developmental directions. We would narrow the contents of the development program accepted by the government if we only considered manufacturing, since research and development, sales and training make also an important part of it.

We do not need to be fortune-tellers to guess--especially if we are aware of the past--that not every one welcomed this development program with bursting enthusiasm. Nor do those developing the program state (or could state) that the concept is free of compromise and that on certain points expectations did not have to be brought in line with reality. It would have been rather dangerous to make irreversible decisions even just 10 years in advance in this rapidly developing field. Thus the 10-year conception treats the two 5-year periods (1981-85 and 1986-90) to some extent distinctly, i.e., at the end of this planning period the program must be re-examined.

Development Scope

The government decision at the end of 1981 has been based on the following facts, data and market tendencies. One on hand, in July 1981, at the conference of the COMECON premiers, a general accord has been signed dealing with "the multifaceted cooperation concerning the uniform basis of electronics products, the equipment necessary for their production, the production of semiconductors and special materials."

In the Soviet Union, electronics parts manufacturing is well developed and at a high level. In the GDR, in 1977, a 20-billion forint value integrated circuit (IC)

capacity was produced, and in the corresponding planning period an additional 50-billion forint sum is allocated to the development and production of newer families of parts and industrial robots. In Czechoslovakia, work is progressing according to the 8 central electronics development planning concepts worked out earlier, and our northern neighbor will spend the equivalent of 60 billion forints between 1981 and 1985. In Bulgaria, as early as 1970, they started to build the background for the electronics industry, and 4 years ago achieved the production of one of the then most modern integrated circuits (MOS-LSI). Although hitherto there are many autarchic elements in the development of socialist countries, finally the 1981 accord of premiers sets forth a coordination of the capacities to be developed in the future (including research, equipment manufacturing and production of materials). This provides the background for the Hungarian microelectronics industry.

Finally it Became a Program

In the meantime, the upward surge of the electronics industry production is uninterrupted in developed capitalist countries; in spite of the recession, it is 10-12 percent yearly. Ever newer efforts are made to design even smaller and smarter components and to realize their production technology. Taking into account the entire process, perhaps it is no longer correct to estimate the progress in generations; one can only see what the world has already achieved and the future (be this a cliche) is incalculable.

Domestically, first it had to be decided if there should be a central development project. The experience of long-range, top-managed programs influencing the production mechanism of the national economy is not always positive. The usual objection: these programs are not really relative to the market and they carry the typical traits of direct supervision systems. On the other hand, the interested parties always urged central decisions--and along with them a program--since this is the best way to get through the bureaucratic labyrinth of economic management; the supply of tools is simpler and certain other preferences are also coupled to this type of long range plans.

The State Planning Board decided already in 1979 (but even then with great delay) to have a central development program. The worsened international climate, however, changed in many respects the original idea; the originally planned license and know-how purchases had to be given up one by one in the sense of the embargo decisions. On top of this, the reasoning according to which we could buy most of the parts on the international market--even cheaper than manufacturing them domestically--became indefensible.

The socialist countries created the microelectronics product variety that would have been acceptable for the Hungarian device and equipment manufacturing industry if it appeared in the sales offering of the COMECON countries. In the current state of socialist integration, however, direct product exchange dominates. The Hungarian electronics industry, however, has nothing to offer; thus, in the long run, we cannot count on imports from this region either.

This does not mean we should strive to become completely selfsufficient. This would be on one hand impossible and on the other completely uneconomical. The task of the Hungarian microelectronics manufacturing industry is to work off with

accelerated development the disadvantage which exists even compared to socialist countries and to create a merchandise base via the offering created by the increased production.

From Electron Tubes to ICs

One may lament and even learn from the downfall of the Hungarian weak-current industry. Supposedly, in the era of electron tubes, there was no significant difference between the leaders and the national industry. The disadvantage occurred during the period of transistors and is growing since. According to the experts, at the beginning of the 70s, the computer technology industry introduced the third generation, the integrated-circuit technology. But as a finished product, computer manufacturing (its related components and the device and equipment manufacturing industry at an ever increasing pace) utilized foreign-purchased ICs. The triumph of the microprocessor touched the Hungarian economy again as a consumer. According to experts, the 1977 license and know-how purchase of Eggesult Izzo--in an isolated fashion--increased at best only our IC manufacturing experiences (and in that only those relative to casing and measuring); the microelectronics industry did not make a breakthrough.

The Hungarian electronics industry with its 110,000 employees and 42-billion forint production assets is ultimately at the crossroads. Either become slowly atrophied--since it started to turn into an assembly-type operation and compete with Far-Eastern countries--or to keep its place on the international and domestic market with a comprehensive program and accelerated development, but taking into account reality. A decision advocating "running fast" was reached, allowing us to maintain our relative international position.

To Think Equipment

The concept is based on the idea not to manufacture catalogue circuits because these can be bought for pennies; the competition is enormous and there is no guaranty that these will become sellable products. Instead, equipment-oriented circuits must be designed, manufactured and sold. Moreover, the kind of circuits that accurately serve the needs of the national equipment manufacturers, since their sale--this way direct--appears more certain. (One must note, however, that 90 percent of the Hungarian industry currently uses catalogue circuits and there is the opinion that equipment-oriented circuits are only used by companies at the top of the trade. According to the technical literature, IBM in the computer industry and Hewlett-Packard in the device industry.) The production of equipment-oriented circuits is better adapted to national conditions, since according to evaluations, a large and well-trained group developed based on the few imported equipment and research.

Circuit design and so-called master mask manufacturing (making sure that design, mask manufacturing and the production of silicon chips fall into the managerial area of the same concern) are related to these as the first steps of the process. (As an explanation, using an analogy borrowed from other branch industries, the master mask is the "casting sample" or in the plastics industry, the "press.") The international market of the master mask is in the process of being established. The price of a single set--in the domain of complexity of those designed by us--is

between 30,000 to 200,000 dollars. A modern mask-manufacturing machine row costs a million and a half dollars and allows the production of one mask per hour. Quick calculation shows that even in the case of masks, it is the mental effort that is payed for.

The other two main points of the microelectronics part manufacturing industry are the refinement of chips and assembly, casing and measurement. According to plans, by 1985, the matching tool park and the group of experts equipped to meet sales and technological demands will be assembled, and the internationally competitive product spectrum will be born.

For Indirect Export

The capacity to be produced must roughly correspond in size to domestic requirements. (Refer to figure.) Thus, besides national utilization, there will be goods left over that may be exchanged in international trade. According to calculations, by 1985, two-thirds of the domestic requirements will be satisfied by domestic production, and the opportunity will be offered to increase by 10 percent the 1980 socialist export; export to capitalist countries will quadruple. (The "basis" of the latter, of course, is very low.) One could say about the program that it is only indirectly export oriented.

According to the plans, in the next 10 years, the domestic microelectronics production will triple relative to its 1980 level, but as early as by 1985, it will almost double. Needless to say, the production mechanism will be completely transformed. Sixteen state and 16 cooperative enterprises will participate in the program.

Between 1981 and 1985, the initial investment of the multithrust program is 3.3 billion forints. This is significantly lower than expected by the profession and is only a fragment of a 1979-version which required 50 billion for the development of domestic microelectronics. Supposedly--although based on a later decision--an additional sum of 7.5-8 billion forints will be needed between 1985 and 1990. And it takes a good many billions to finance program-related research and development, license fees and R & D investments. Thus, the total is a significant sum.

With a Basic Allowance

Fortunately, initial investments are almost exclusively in the purchasing of machines and equipment. The companies participating in the program could not even contribute 10 percent from their financial base to the development (but this is always a characteristic trait of central development projects!) The largest money source (more than two-thirds) is covered by an installment-due basic allowance. Six hundred million in the initial investment of the whole program comes from centralized technical development funds.

There is nothing objectionable about this, since nowhere in the world did microelectronics develop without central and more or less free support. The preliminary economic calculations suggest good results. This way, the net production per employee will increase 3.5-3.7 times, and the net income of the participants 5

times. The 1980 9.4-percent net profit proportionate to production means will increase to 27-30 percent.

The lion share of the implementation of the program is entrusted to the Microelectronics Enterprise. (We hope that the company will receive a more "market-viable" name!) The primary objective for the establishment of the company is to concentrate the innovation chain into one hand. The designers' inaptitude, technological and technical "philosophy" all contributed to the fact that the national microelectronics industry achieved little success in the past, even relative to its limited potentials.

This fragmentation had, however, its advantages. The competitive situation, the competing companies reaching and renouncing temporary agreements, aimed at the ever-faster increasing of their professional knowledge. (That is why those evaluating the situation found that in the supply of leading experts, we are not doing that badly!) Professional jealousy is the possible "time bomb" of the program, even despite the gradually developing system. That is exactly why this development company should concentrate the best of the profession. The goal is to make participation in the program attractive both in the short and the long run. One must therefore agree that salaries will be increased at the beginning by 25 percent in the profession (including the new company), and, in the future, salaries will depend on profitability.

Depends on Agreement!

It is a question how the most outstanding experts who showed little readiness to cooperate in the past will work together as colleagues, subordinates and supervisors. And this is no longer a question of salaries and compensations, but rather a moral problem.

One cannot expect wonders from the microelectronics program just born. Hungary is not going to become--even if the program is perfectly implemented--a superpower of microelectronics. The conditions and opportunities mostly amount to allowing Hungary to properly equip its economy with electronics and providing a basis for exchange with socialist--and to some extent capitalist--countries in the given product line. At first glance, this is not a very large caliber task, but the most that we can do, now, at the beginning of 1982.

CSO: 2502/38

USE OF PARALLEL SYSTEMS IN HUNGARY

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 4

[Article by Akos Bodlaki: "Parallel Information Processing, Cell Automatons, Parallel Processors, Multiprocessors"]

[Text] We followed with great interest the series of articles on parallel processing, examining the subject from many viewpoints.

We are fortunate to be among the first users of parallel processor systems in Hungary, in a "sharp" application, at the upper level of the hierarchical management of the Hungarian electrical power system: namely, with a MIMD-class, multiprocessor-architecture computer system based on miniprocessors.

In this article, we deal with the architecture itself (we shall cover the application details in a later issue), furthermore, in connection with this, we shall make a few comments touching on the questions posed in the discussions which took place up to now.*

Architecture

As early as toward the end of the sixties, the problem of automatic system supervision and control were examined in the National Electrical Load Distributor (OTV). Following a very thorough and lengthy preparation, in the middle of 1976, they decided on the HIDIC-80 multiprocessor system of Hitachi. The system was delivered with the specified functions in March 1979, following a successful testing period. Its hardware and software specifications and preparation of user's software were completed with the close cooperation of Hitachi and OVT experts.

Thanks to this, the consideration worked out by us could be realized by the characteristics of the multiprocessor architecture.

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*We expected to complete the series with the publication of Subsection V which appeared in our October issue. The manuscript received in the meantime in our editorial office describes a nationally implemented successful application and considers the hitherto published articles of the series: thus it complements the subject.

Let us highlight a few system-design considerations:

--modularity, allowing the modular expansion of the system, while preserving the original system to maintain the pace dictated by the increase of tasks resulting from the technological-system and supervision-requirement growth;

--task increases must be implemented in such a manner that system throughput, the reaction time of real-time functions is not reduced;

--over 99.95 percent availability for vital on-line functions;

--the system must have a mixed-mode operation in the sense that it must allow beside the execution of on-line process-control functions the running and development of off-line programs--in the given case, using on-line technical data as input data.

The system selected (described in detail in a later issue) manages to satisfy the above stringent requirements.

Let us mention some of its typical systems characteristics:

--it can contain a maximum of eight processors;

--main modules: global memory (GM), processors, crossbar bus system with bus drives, peripherals;

--dynamic allocation capability between processors and peripherals;

--interprocessor communication: task (program registered in the operating system), synchronization, mutual diagnostic supervision, configuration control (e.g., during a switch-over);

--multiple access to given peripherals;

--dual write into duplicated menories (e.g., GM, fixed-head magnetic disks).

From the system with the above characteristics, we configured a dual-machine system that satisfied the specified tasks. The dual-machine system operates in the master-slave mode in such a manner that is satisfies the mentioned important requirements (99.95 percent availability, modularity, performance of off-line functions without a disturbance of on-line functions, etc.).

We note that the master-slave dual system can, of course, be configured from monoprocessor systems; practical experience shows, however, that even a primitive, i.e., two-processor, configuration is advantageous because of the favorable characteristics hidden in the architecture.

Based on the experience gained in OVT, we highlight the following favorable characteristics:

--offers the immediate opportunity for the implementation of a fault-tolerant system (multiple disk access, dual write, hierarchical bus system);

--response time was reduced with the sharing of the two processors for nonvital but extensive on-line functions;

--economical utilization of certain peripherals by the processors (reallocatability);

--repair of faulty peripherals during on-line operation, i.e., maintenance is possible without a disturbance of the on-line operation (reassignment to off-line processor);

--a program tested for syntax and with off-line data can easily be tested with "live" on-line process data (this may be very important during the implementation of an on-line function);

--in this type of master-slave operating mode, the switch-over in case of a faulty on-line processor is rapid and reliable (configuration control).

We mention a few arguments brought up against multiprocessor systems. For instance, a hardware failure on a given bus of the bus system paralyzes the communication between the peripherals on the bus and the processor. According to another opinion, the number of crossbar points significantly increases when a new processor and bus are added.

Our experience shows that, while these are of course true in theory, they do not play an important role, as long as the hardware--especially the bus drives and the interface circuits of the peripheral drivers, connected to the bus--is highly reliable, and the increase of the crossbar points does not cause any problems if a low number of processors and buses are used. Nevertheless, the use of more (over five) processors must be thoroughly thought out, because with an increase in the number of processors, in the case of poor system design, the overhead resulting from the interprocessor communication may significantly increase, and configuration control and the scheme for setting up spares become complicated.

OVT's hardware system is highly reliable (its availability was over 99.95 percent during approximately 2.5 years).

In practice, "bus freeze" never occurred. Moreover, the increase of crossbar points does not reach a point (and will not even in the future) which could cause problems either technically or financially. Under any circumstances, the physical implementation of points is such that these problems cannot cause any practical difficulties. Much more care must be taken in the increasing of the number of processors and buses in regard to an as simple as possible spare scheme and the overhead time resulting from interprocessor communication. These can be mastered, however, by a well-thought out assignment of the peripherals and functions to the processors (basic configuration).

Paying Special Attention to Parallel Operation

The foregoing description of the OVT's MIMD system was perhaps useful in providing the reader with the main characteristics of the system and thus will make clearer the few observations we should like to make in connection with the discussion on parallel processing in the magazine.

In the discussion, much has been said about the relationship between the parallelism of the application area and the parallel architecture of the computer system used.

As we know, there are several classes of parallel processors. It is not worthwhile to describe the classification criteria; we can easily see, however, that the particular architecture is fundamentally influenced by the level of the parallel operation. Basic instructions can be at the execution level (AP 120B), program-module or block level and at the level of well-definable functions. In a practical application, a mixture of these--e.g., a bulk processor connected to a multiprocessor system--may occur. In our opinion, it is fundamentally important to properly consider the agreement of the nature of application with the architecture used.

The management of electrical power systems is a typical area where the scope of tasks to be implemented can be divided into well-defined functions that can be conveniently divided up among processors with corresponding synchronization, but in such a manner that real-time prerequisites are not jeopardized. (Real time itself is a relative concept and reflects the application area. Moreover, even within the application area, it is a function of time. This could also be a separate topic for discussion.) In OVT, this division is only valid for a few functions due the present minimum number of processors, but one of the important points of the system development is the division of functions-partial functions among the processors. Depending on the magnitude of the task, micro- or minimultiprocessor systems appear well suited for these and similar applications (sas-, oil-, water-supply control systems) based on foreign (American and Japanese) examples. We can mention the interesting point that a bulk processor--as a unit connected to a bus--for the performance of a large amount of arithmetic operations can also be used within this system. For example, for the performance of operations in connection with large-scale network flow and stability relations and large matrices.

One of the key questions of the discussion in the magazine involved practical application and production possibilities in our country. Cell systems were mentioned, for which producibility is fundamentally influenced by the existence of the necessary technology (VLSI).

We find the miniprocessor multisystem educational also from the national viewpoint. Countries more developed than Hungary are also faced with the dilema of choosing the right class or classes of parallel systems. (Rich countries with sophisticated computer technology project ever more and, productinally speaking, ever bolder architectures.) Our experience gained in Japan (Hitachi, Toshiba, etc.) shows that, if a company has significant experience with small machines, then a possible path is to design a multiprocessor system based on such a

nonspecialized small machine (Japan, of course, is involved with other architectures as well); i.e., to complement it with all those hardware and software elements through which we set a real multiprocessor system. (This, of course, requires a serious development effort even for a large company.)

We are not going to elaborate on what we mean by "real" multiprocessor system. We merely note that the possibly existing small machine requires significant hardware development (bus system, bus driver, multiple access, dual write, automatic copying, global memory management, etc.) to make the throughput and the response time of the system satisfactory. Softwarewise, the basic configuration implemented should not affect previous characteristics.

To characterize the system, we could mention that in the small-machine category we know several examples where the operating systems of the processor modules are not that different from conventional real-time operating systems (they may even be sold as monoprocessor configurations); however, the modular character of the operating system allows the multiprocessor system to be configured with the so-called multisystem modules connected to the basic system.

In closing, we would like to express the hope that the foregoing developments in connection with the domestic production and use of parallel systems will not remain at the level of discussion but be moved from the level of being individually "housed" to a more coordinated and better organized level by potential developers and manufacturers.

This may be important in national process and production control (which, to be modest, still faces development). In this area, according to practical experience, there is a great need for reliable, fault-tolerant, quick response-time and adaptively configurable systems. Its importance is even greater, since industrial process control and related production control are decisive in the light of the current timeliness of productivity.

9901
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ES 1015 IN PRODUCTION

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 5

[Text] According to the agreement between VIDEOTON and the Computer Technology Coordination Institute (SZKI), in Szekesfehervar, the Experimental Installation Association (SZKUBT) started the production of ES 1015 computers. SZKI, which developed this modern computer tool for the order of VIDEOTON, is havint it manufactured as a distributor, handles the transportation of systems ready for use, their warranty and complete support according to user demands. Relative to these activities, SZKI organized a 3-day seminarium in October in Visegrad. During the event that was rich in meaningful descriptions, demonstrations and evening discussions, Pal Nemeth, Vice Director, and his colleagues informed the potential users of the ES 1015 about the points relative to the production and technical support, etc. of the computer.

New Member of ESR 2 Series

It was mentioned that the experience gained gy SZKI during the development of ES 1010 and 1012 significantly contributed to the successful development of the new computer. That, despite of this, it was not an easy task is illustrated by the following comparisons. While the ES 1010 and 1012 systems required 60, respectively 90 men per year, the ES 1015 required 390. If we take into account the number of the built-in integrated circuits, we have the following figures: 1500, 3500 and 12,500.

The new computer system is the smallest model of the second ESR series. It is fully compatible with the computers of the series, the ESR 1020 of the first series of the ESR and their larger models, and with the members of the IBM 360 and 370 family. It can be effectively used in stand-alone systems and as a station in computer networks. Its system configuration allows local and remote and batch and interactive operating modes. The new multiprocessor, virtual-memory and high-speed computer has a 256-kbyte working storage in the basic configuration. Its arithmetic speed is 20,000 operatins per second. Its instruction repertoire corresponds to the requirements of ESR expansion and, thus, includes floating-point, binary, and decimal arithmetic instructions. To program it, the user can choose from six programming languages. The operating system is virtual memory management ESR DOS-3, but it is capable of using IBM DOS/VS. In the computer, more than one program can be simultaneously executed, since memory protection safeguards the contents of main memory with dynamic

lable translation. The compatibility of the ES 1015 provides wide adaptability for the system; its users can count on a wide spectrum of program packages. Characteristically, its floating point operations are of more than average accuracy. The system monitors the correctness of instructions and data during program execution and is able to distinguish between programming errors and hardware faults. Troubleshooting procedures used to remove machine faults involve the correction of faults, the repetition of microinstructions, and the recording of data relative to the condition of the system.

First Ten

In connection with the computer system which can be effectively used in various areas of the national economy and which will soon be on the market, Janos Rudas, department head of SZKI, mentioned that demands presently exceed capacities. Before the end of the year, a total of 10 ES 1015s will be produced. If all goes well, the first five will be put in operation around January - February. The next five machines are planned to be delivered by the end of August.

9901
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TASKS INVOLVED IN REMOTE DATA PROCESSING

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 6

[Article by Dr Josef Gonczy]

[Text] In the past, in our country, remote data processing was characterized by the employment of medium-size (less frequently, medium-large) computers. The computer centers based on thes generally functioned--from the viewpoint of on-line traffic--in an isolated manner; information inflow was handled by local data carriers (e.g., punched tape, magnetic tape, etc.). The results were sent to the user also via off-line means, e.g., continuous printouts (less frequently via magnetic and other type of data carriers).

The technological and technical developments of recent years allow the utilization of new designs and produce new remote data processing tasks which cannot be implemented via conventional methods. The technical possibility for the setting up of remote data processing systems has been enhanced and, at the same time, the remote processing demand has been fiercely increasing.

It has been determined at several management and technical forums that, compared to other achievements in computer technology, remote data processing is falling behind the planned results.

To accelerate catching up, the sixth Five-Year Plan of the Computer Research Goals Program devotes a separate chapter to remote data processing tasks. The chapter summarizes the actions to be taken in two target tasks, the first one being remote network research and development. The second one (the one being described) contains the applications development tasks; they have been accepted by OMFB and KSH as remote data processing application target tasks.

During the preparation of the target task, it was demonstrated that most of the planned remote data processing tasks can be implemented by a star-connected network system built around a large computer; thus, the target task mostly deals with the implementation of this system.

The imported computers of the sixth Five-Year Plan belong basically to the second series of unified computer systems (ESR); in addition, minicomputer systems (MSR) are also imported in significant numbers. Corresponding to the international experience, the user has an increasing demand for the two extreme poles

of computational power: ever larger computers (second ESR series, 1 - 2 Mbyte working storage, 6 - 12 100-Mbyte disk units) and minicomputers (MSR series). The role of medium-size ESR machines is decreasing; for this reason, perspective remote data processing development must support the above two areas of application. In addition, the support of remote data processing requirements of the existing machine stock (above all ES 1040 and 1022) must be taken into account; the development tasks relative to this are also a part of Target Task 52.

Goal and Result

The basic goal is the development of remote data processing subsystems based on ESR 1 and ESR 2 computers and needed by company-management users of MSR machines for complex remote data processing tasks; the supporting of their hardware and software requirements; facilitating their broader use and installation; their integration into other systems (operating systems, data base management systems, application program development systems) to make up a unified system.

The result: a remote data processing hardware, basic and system-software module kit is produced, which fits into the peripheral system of ESR software support.

Typical features of the module kit:

--from the remote data processing components corresponding to the application task requirements and from the framework-system modules complex hardware and software systems can be created which are cheap to install and easy to use;

--can be used in complex application systems with MSR and ESR machines;

--the functioning, effectiveness, and easy-to-use character of the remote data processing system components can be demonstrated.

During the implementation of the target task, at the time of the generation of the remote data processing hardware-software system, we must strive for the following:

--must rely on the elements of domestic or ESR production base;

--must be able to be integrated into the peripheral systems providing basic software support for ESR machines, which are set up by the Computer Applications Development Fund (SZAFA);

--must be adapted to the application and program development systems which are already available or are to be acquired;

--must satisfy the remote data processing requirements of the important company, branch-industry and regional managerial systems of the national economy.

In addition to impelemnting at the national level the data base management and data transmission tasks of ESR machines, it must implement the similar tasks of MSR machines while maintaining compatibility with ESR machines. Thus, ESR/MSR level, complex shared application systems can also be created.

Prototypes

To implement the task, remote data processing prototype systems based on ESR 1 and ESR 2 series computers must be created and operated, which contain mostly domestic--or, if necessary, socialist import--remote data processing system components and MSR-based intelligent remote data processing components.

The prototypes allow:

--to demonstrate the functioning and applicability of various remote data processing systems;

--the testing and system integration of remote data processing system components manufactured by various companies;

--the testing and system integration of new units developed or acquired for the software peripheral systems;

--to provide future remote data processing users with machine capacity, which facilitates the training of users and the installation of their computer, moreover, after the adjustment of the installed computer, support the users to reach full capacity.

In the framework of the target task, we are planning the production of two prototype systems, which are decidedly based on present devices of OSZV; the acquisition of equipment necessary for the expansion is in progress.

Structure of the ESR 1-based prototype remote data processing system:

--ES 1022 computer with 512-kbyte main memory;

--29 Mbyte magnetic disk;

--ES 8410 TERTA multiprocessor;

--VIDEOTON, TERTA, ORION terminals.

Structure of the ESR 2-based prototype system:

--ES 1055 computer with 1 Mbyte main memory;

--100 Mbyte magnetic disk;

--ES 8371.01 TELE JS remote data processor;

--MERA individual and group terminals;

--VIDEOTON, TERTA, ORION terminals.

For both systems, as intelligent terminals, we would like to use MSR (SM-4) minicomputers. In the selection of terminals, we consider two significant

points: one, to avoid software problems, we strive for as perfect compatibility with IBM terminal management as possible; two, due to the demonstrative and referential nature of the prototype systems, we would like to use all terminal types suitable for service to increase device choice.

The following tasks must be implemented to create the prototype systems and reach further long-range goals:

--testing ans possibly necessary adaptation of remote data processing hardware devices needed by the prototype systems;

--integration of the corresponding software modules (modifications), which serve the hardware units, into the peripheral system providing the domestic ESR software supply;

--integration of interactive program development and remote off-line program execution tools into the peripheral system;

--selection of remote data processing monitor, its adaptation to and interface with data base systems, the support of domestic remote data processing elements;

--employment of an MSR computer for terminal emulation, provision of remote data processing service system programs for the MSR;

--concrete software support for the ESR 1 and ESR 2 prototype systems via the established peripheral systems, the preparation of data-base and data-transfer interactive demonstrator programs;

--preparation of application data-base and data-transfer sample systems for the measuring of installation efficiency;

--integration of prototype-system services into the services of other ESR and IBM computers;

--benefiting from the accomplishments made during the implementation of the network remote data processing target task (Target Task 51) of the SZKCP and the integration of software products into the peripheral system.

The last two tasks will not be handled until the second half of the planning period: these questions so beyond the star remote-data-processing system and point to network applications.

Financial Sources

The target-task plan composed by SZAMKI and OSZV has been accepted at the necessary forums; the financial support necessary for the implementation will be provided by KSH, OMFB, the Ministry of Industry and MTA; in addition, significant expenses will be covered by the institutions managing and implementing the task (OSZV, SZAMKI, SZAMOK). Contracts have been drawn up for the concrete provision of financial coverage; in the execution of the work program until 1985, a wide spectrum of the national computer institutions participates; the preparation of the contract system resulting in the division of the work is in progress.

MULTILEVEL INFORMATION PROCESSING SYSTEM BASED ON ESR AND MSR EQUIPMENT

Budapest SZAMITASTECHNIKA in Hungarian Nov 81 p 7

[Text] The article presents the hierarchical computer system, consisting mostly of ESR and MSR hardware and software components. The first part deals with the theoretical structure of the system; the second part presents a specific application.

Structure

The system is divided into three levels (figure 1): on level 1, we find the central processing system. Its task is to control a network consisting of 30 regional centers, route messages between regional centers and collect and process data from the centers. The displays concerning the total system and summaries are prepared, and the archive data base resides here.

The regional centers accept and process in accordance with the given area the data received from the lowest level and transfer the compiled information to the upper level. The active data bases of the system function in a decentralized manner in these regional centers. A further task is the preparation of regional summaries. The main task of the local data stations is the preliminary processing of data. In the process of doing this, they can communicate with the data base of the system. The gathered source information can be transferred either to the regional center situated on the individual line or to the central system. The local data station prepares the result evaluations and summaries for the given subunit.

There is a telephone connection between certain levels of the hierarchy; the data transfer speed is 1200 bauds at the minimum.

The main hardware unit of the central data processing system is some second-series large ESR computer (ES 1035, ES 1045, ES 1055, ES 1060, etc.). The operating system used is a version of ES OS 6.1. The message switching of the regional centers is handled by an increased-reliability (dual-processor) SM-4 system. For this purpose, the special software created based on the message-switching and data-collection analogy is used. The interface between the ESR and MSR machines is accomplished via an adapter corresponding to the DUP 11 and CX11.

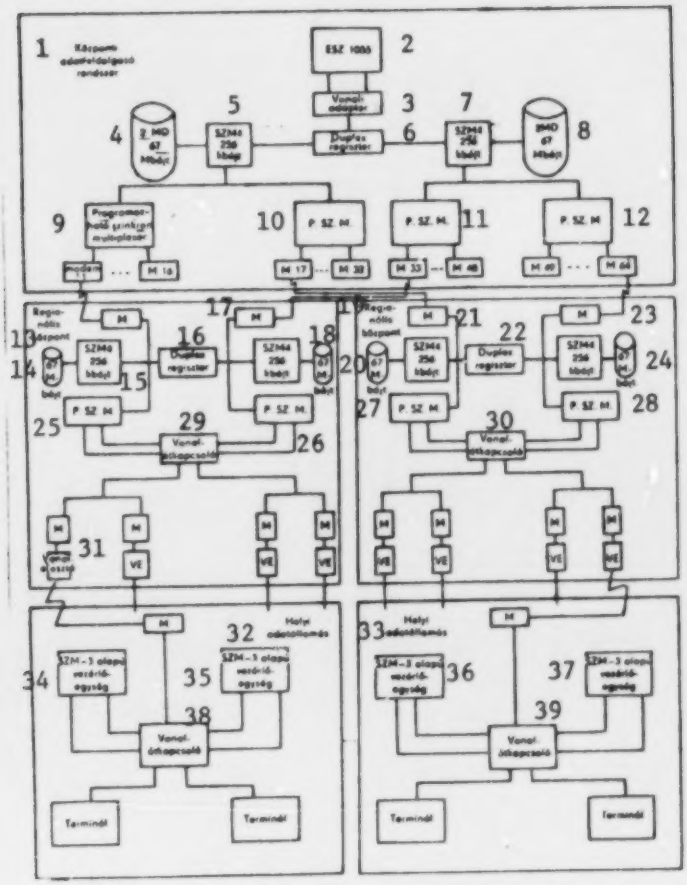

Figure 1. Multilevel System Outline

Key:

1. Central Data Processing System
2. ES 1055
3. line adapter
4. 2 MD 67 Mbyte
5. SM4 256 kbyte
6. duplex register
7. SM4 256 kbyte
8. 2 MD 67 Mbyte
9. programmable synchronous multiplexer
10. PSM
11. PSM
12. PSM
13. Regional Center
14. 67 Mbyte
15. SM4 256 Kbyte
16. duplex register
17. SM4 256 kbyte
18. 67 Mbyte
19. Regional Center
20. 67 Mbyte
21. SM4 256 kbyte
22. duplex register
23. SM4 256 kbyte
24. 67 Mbyte
25. PSM
26. PSM
27. PSM
28. PSM
29. line switch
30. line switch
31. line distributor
32. Local Data Station
33. Local Data Station
34. SM-3-based control unit
35. SM-3-based control unit
36. SM-3-based control unit
37. SM-3-based control unit
38. line switch
39. line switch

In the regional centers, dual-machine SM-4 systems are used; these are equipped with the tools necessary for remote processing. The operating system software of the system corresponds to the DEC RSX 11M.

One possible hardware implementation of the local data stations involves the use of dual SM-3M systems. On the software side, a real-time operating system is needed. In the implementation of the above structure, it is possible (and necessary) to use a few tools imported from the West. Such are the 67-Mbyte magnetic disk of Control Data and the TC-800 terminal of Olivetti.

Moscow Example

A typical design of multilevel hierarchical computer systems is found in the Moscow savings bank. The task of the GTSK-Moscow system (henceforth referred to as "system") is the performance of customer-related services--deposits, withdrawals, interest computations, etc.--and the execution of the related accounting functions, preparation of summaries.

The number of the savings bank locations served exceeds 3,000. There are 2 - 12 workstations--depending on the nature and quantity of the work to be done--in the savings bank branches. A central savings bank has 32 branches. The number of personal accounts handled exceeds 8 million. The yearly growth rate is 5 percent. The performance of data processing tasks is done in the batch mode; customer services are on-line. In the central savings bank, in addition to customer services, the data base of the deposit accounts is managed; summaries are prepared and bookkeeping functions are performed.

The system is implemented at two levels (figure 2). On the upper level, we find the dual-machine SM-4 systems of the central savings banks with the devices necessary for the message-switching and controlling of the terminals. The terminals are Olivetti-800 devices. The remote processing functions of the system are performed via telephone lines.

What requirements should the software of the system satisfy?

Reliability and recovery; forging data collection, formatting, input, storage and processing into a unified process, the appropriate supervision of individual steps; expansion capability; security; easy use. The SM-4 subsystem employs the well-known RSX-11M operating system. The TC 800 has two operating systems: the batch-mode DOS and the real-time COSMOS.

From the application software of the TC 800, we highlight the ZTM and INCAS program packages. ZTM plays a role in data input and output and screen formatting. INCAS handles in the on-line mode the controlling of common peripherals, processing of operational failures and dialog control.

System monitors ensuring the functioning of the SM-4 application software:

--The system can function as a terminal concentrator with the aid of SKLS. It ensures transit, local and mixed switching mode. The concentrator mode can be dynamically changed.

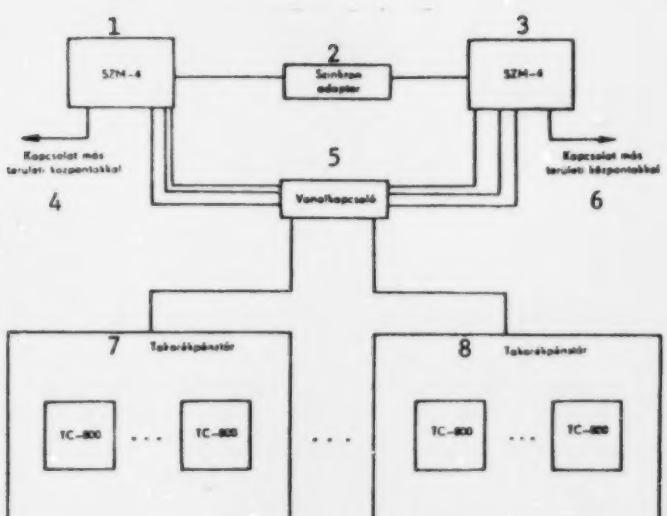

Figure 2. Structure Outline of Area System

Key:

1. SM-4
2. Synchronous adapter
3. SM-4
4. Connection to other area centers
5. Line switch
6. Connection to other area centers
7. Savings bank
8. Savings bank

--The SOT transaction monitor serves for the automation of the work connected with the archive files. It accepts messages from local and remote terminals, processes them, manages the user and system files, completes the restart and recovery process.

--The savings bank system significantly improves the services provided to the population. It makes any personal account accessible. The opportunity is offered for the reduction of cash transactions, which allows the transferring of supplementary money bases.

The system offers valuable experiences in the use of multilevel networks. It provides especially good reference for SM 4 computers. At the same time, at the highest level, it does now, however, show the connection to ESR systems in its present design. In spite of this, it proves that MSR technology is suitable for the implementation of the most modern computer technological structures.

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3 March 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 733

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3 March 1982

EAST EUROPE REPORT
SCIENTIFIC AFFAIRS

No. 733

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FEED MIXTURE INCLUDES SAWDUST--An experiment at the 1 May Unified Agricultural Cooperative in Trnava to save grain by replacing 20 percent of feed mixture for hogs with hydrolyzed sawdust has proved successful. Only sawdust from hardwood is used, which is easily available from the wood-processing plants. Hogs fed with this mixture attained daily weight increases of 72 decagrams compared with 68 decagrams for hogs fed with regular feed mixture. The experimental fodder also made hogs satiated, whereas regular fodder made hogs restless and unsatiated. Additional experiments in this line will be conducted by the regional station of the Institute of Scientific System of Agriculture in Levice. [Bratislava SMENA in Slovak 11 Feb 82 p 1]

CSO: 2402/31

CONDITIONS, POSSIBILITIES FOR WORKING ABROAD REVEALED

Budapest MUSZAKI ELET in Hungarian 27 Dec 81 p 9

[Interview with Janos Gardos, department head of the Office of Technical-Scientific Cooperation, by Erika Mocsari; date and place not specified]

[Text] [Question] Looking at the heart of the matter, we asked Janos Gardos, department head of TESCO [Office of Technical-Scientific Cooperation], this question: "Is it true that the technical intelligentsia is not familiar with the conditions for employment abroad?" Recently we had become aware that the technical intelligentsia, primarily engineers working in factories, do not exactly know where and how they can apply for such employment.

[Answer] The question is an exaggeration. In recent decades, approximately 10,000 Hungarian specialists--to be sure not all of them technical--have worked in developing countries; almost 1,000 are engaged in Third World countries.

[Question] How does TESCO publicize the opportunities?

[Answer] It is our goal that as many persons as possible should be aware of the invitations for applications and know of the opportunities. To this end, we publish many announcements regarding the invitations on radio and television, in daily newspapers and trade papers. We also publish detailed announcements in journals.

[Question] How should one apply and what must the applicant know?

[Answer] The basic condition is a number of years of professional experience and a knowledge of languages. As well known, a significant share of the Hungarian technical intelligentsia speaks primarily German, while we send specialists to English, French, Spanish and Portuguese language areas. The first problem begins here. For example, if someone applies for a teaching job, it is not sufficient for him to know the language of the area; he must also have passed a proficiency examination. In fact, a degree is also desirable. Moreover, the applicant must also be supported by his own factory and its superior authority. If the applicant takes the position, he is on leave without pay during his mission, and the employer must take him back upon his return home. During his absence, he is given a specified salary by the Ministry of Finance.

Frequently, the employing enterprise will not release the technician but will classify him as indispensable. In this case, unfortunately, TESCO cannot send him abroad.

[Question] Can Hungarian specialists still apply for work in 1982, and if so for what areas would TESCO accept applicants?

[Answer] There are still many vacant positions for 1982. One of our most important partners is Libya, where the Hungarians abroad are engaged chiefly in the public health area. But there are still many other vacant positions for 1982. For example, we are searching for technical teachers and for experts in water management. The water management department of the Libyan Ministry of Agriculture has asked us for 15 experts to set up the water management organization. We have three to four applicants. Nigeria would welcome applications by technicians who have a scientific degree, speak English, have several years of teaching experience at home and would be willing to teach at universities (in the various provinces). In addition, Nigeria has a demand for a large number of Hungarian specialists in architecture, primarily in the implementation of urban planning programs. Tanzania has primarily a need for university instructors, economists and architects. Here the condition for application is at least 10 years of professional experience and a knowledge of English. For Mozambique we want machine industry specialists with a knowledge of the Portuguese language, primarily in the vehicle industry area and in certain other machine industry trades. Architects, mathematics instructors, physicists and biology teachers can also apply for positions in this area. Mechanical engineers, weak-current engineers, technicians in agricultural machinery repair, automobile industry engineers and hydraulic specialists may apply for assignments to Angola in 1982. We are looking for strong-current engineers, mechanical engineers and architects to send to Iraq. Algeria has asked us for about 60 technicians. These positions are still unfilled.

The selected examples from these countries demonstrate that we would welcome the participation of many technicians. Of course, I did not mention the broad-scale demand abroad for public health workers. Therefore, if anyone should want to apply for a multi-year foreign assignment and would like to become familiar with the details, we can give additional information at the TESCO foreign operations department (Nagy Lajos kiraly ut 202, Budapest 14).

[Question] According to our information, TESCO has some other foreign business opportunities.

[Answer] Yes, we have. The examples mentioned were taken primarily from foreign jobs in the framework of technical-scientific agreements. In addition, TESCO recently has fulfilled many foreign commissions. These have been, for example, in road construction, installation, and the planning and implementation of hospitals and other communal facilities. We have close business ties with many Hungarian planning institutes and enterprises. We regularly send Hungarian specialists to carry out their assignments. I might give a number of examples: in Algeria, stadium construction and the planning and operation of various hospitals; in Nigeria, city stadium planning; in Libya, the planning of railroad construction tasks, the planning and operation of hospitals and the implementation of water management programs. If a technician desires to represent Hungary abroad, he can apply at our office independently of the application system framework in which an assignment might be available.

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NEW APPROACHES TO HIGH PERFORMANCE SYSTEMS, USSR

Budapest SZAMITASTECHNIKA in Hungarian Oct 81, p 4-5

[Article by Viktor Aladyev: "Parallel Information Processing, Cell Automats, Parallel Processors, Multiprocessors: A New Approach to High Performance Systems"]

[Text] The concluding article of our series, which has been appearing since the first of December 1980, offers a glimpse of the concept, methods and achievements of the school of Soviet cell automat research led by Aladyev.

With this article the editors of our journal are making up for an omission, informing the readers about the future of the ESZR [Uniform Computer Technology System] and trends which will certainly affect the computer technology face of our homeland also.

The work of the Aladyev group cannot be regarded as an isolated, ad hoc attempt, an individual searching for paths by scientists on the periphery of research, who must "prove themselves." Soviet cell automat research takes place in an organized way in the Tallinn section of the Soviet Technical Design Institute.

It is enough to leaf through Aladyev's 267 page monograph titled "Mathematical Theory of Homogeneous Structures and Their Applications" (Tallinn, Valgus, 1980) and the bibliography consisting of 210 citations to get a picture of the place occupied by Soviet cell automat research in the world. Even listing the co-authors suggests much: Yefimof, Osipov, Klushnyikov, Polyekov, Fishman, etc. Not even to speak of others working on the theme such as Shcherbakov, Lukashevich, Vinograd, Makarevski, Glushkov, Varshavskiy, Yevreynov, Kosarov, Vasilyev, Chadeyev, Horochevski, Golovkin, Podkolzin and others. --the editors.

The Limits of the Serial Principle

The time is approaching when the serial processing principle of the Neumann type--which is used as a basis for the most extensive modern electronic computers--will begin to play a retrograde role in the development of very efficient information

processing systems. The individual calculating machine model recommended by Janos Neumann in the 1940's is the basis for modern computer technology and the starting point for the so-called Neumann approach to computation.

The inclusion of automated processing systems in the currently greatly expanding applications areas results in an increase in the quantity and complexity of the information to be processed, which puts higher demands on the capacity of the computer technology which can be used. At the same time, the development of computer technology (within the framework of the serial processing principle) is certainly approaching saturation, because the presently existing electronic computers are not far from the theoretical limits of the operational speed of such systems, which are defined by the physical properties of the components.

But the theoretical limit is set by the serial model of processing. As a result any increase in operational speed is accompanied by significant costs and this cannot but have an effect on the development of information processing systems and the economic efficiency of their operation. As a result of all this there is a need to seek for new basic principles in the area of the structure of computer systems and, actually, in the area of the organization of the computing process.

Upon What Does Performance Depend?

The performance of computer systems is determined by a number of factors among which, in my opinion, the following are worthy of mention: on the one hand the element base and architecture of the computer systems and on the other hand the algorithmic and information structure of the tasks to be solved in the computer systems. While the first factor (in this regard) defines to a significant degree the absolute performance capacity of the computer systems (whatever the task), the latter influences the relative performance capacity, which depends on the tasks to be solved. Thus improving the element base and architecture of the computer systems increases the processing speed of every task to be solved but by improving the structure of the concrete task we increase the processing speed of the given task with an unchanged organization of the computer system. It follows from this that the processing speed of a task is determined by the absolute performance capacity of the computer system and by its relative performance capacity as well. In the event of an optimal correspondence between the architecture of the computer system and the structure of the task this speed will be the greatest--other factors being equal.

Within the framework of the serial computing model the information processing speed has been and is being increased in all the above directions, cultivating the absolute and relative performance capacity of the computer systems. For example, we can easily see from the succession of three generations of electronic computers the ways in which the element base and architecture of computer systems have been improved, which resulted in increasing absolute performance capacity. The results achieved in the areas of the theory of serial processing algorithms and of the design of data structures, on the other hand, helped in large measure in the solution of problems connected with the construction of fast algorithms and with an improvement in the information structure of tasks to be solved. Thus, within the framework of the serial computation model (for the given class of computer systems) we are quickly reaching a state of saturation, where significant expenditures are needed to achieve relatively small increases in the processing speed of tasks. The question arises: What prospects can we count on in this area?

The Parallel Processing Model

This is the basis for a non-Neumann approach to computations. But we should not think that the parallel processing principle represents something new in computer technology. At the very dawn of computer technology Babbage established that a simultaneous processing of parts of a computation process, independent of one another, was possible. The parallel processing principle has been used to a greater or lesser extent even in electronic computers built on the basis of the Neumann computation model, in accumulators and control registers, beginning with bit organized information processing done when combining operations all the way to input/output and the parallel distribution of actual processing. But more serious work began only with the appearance of parallel computer systems. These are actually systems built up of computers standing in a mutual relationship to one another, capable of processing various parts of the same task simultaneously. Significant theoretical and applied results have been achieved in the area of the so-called functional parallel distribution operational mode, the essence of which is the parallel running of several parts of the computation algorithm on separate computer technology devices, with a parallel distribution to various depths--broken down by operations, instructions, commands, blocks, etc. A number of parallel computer systems have been designed or built to realize the functional parallel distribution operational mode, with appropriate parallel program support (software), which have very good performance in regard to a number of classes of tasks (for example, matrix tasks, form recognition, trace following and control tasks). For a number of tasks the functional parallel distribution operational mode realized in parallel computer systems has achieved a significant time saving in the course of processing. But a number of essential viewpoints must be watched out for when using the functional parallel distribution principle.

In the first place, it is necessary to develop special parallel computer systems and parallel software, which require a rather complex structure in the functional parallel distribution operational mode, and the functions connected with maintaining the functional parallel distribution operational mode in parallel computer systems make necessary significant time expenditures. As a result of this the average time saving for information processing done in the functional parallel distribution operational mode in parallel computer systems does not exceed 15-20 percent; the maximal time saving cannot be K-fold or more, where K is the number of processors performing parallel processing in the computer systems. In a number of cases the process of the parallel distribution of tasks represents a difficulty. Work is now being done in connection with functional parallel distribution, and we can count on substantial progress here. Questions are arising in connection with other operational modes and in connection with a detailed examination of the essence of parallel distribution, in regard to increasing the speed of information processing. The Technical Sciences State Committee of the Soviet Union has included this sphere of problems among the most important tasks of computer technology and programming in the period 1981-1985.

Homogeneous Structures

Within the framework of work connected with theoretical research on homogeneous structures (cell automats, iterative automats, cell structures, etc.) and parallel algorithms the Estonian section of the All Union State Technical Design Institute of the Central Statistics Office of the Soviet Union began, in March 1979, work connected with practical testing of a number of possible approaches to parallel

information processing. Along this path we defined and examined the parallel information distribution operational mode, the essence of which is as follows.

Let us presume that we must solve a task M using information base B. Let us presume further that algorithm A which solves task M consists of K number of algorithms A' which handle B_i number of (U_i B_i - BO (l_i - I, K) information bases without common parts and that on the basis of the results of running the A' algorithms the algorithm C giving the final result of task M can be depicted in the form of an algorithm linking these part algorithms. In this case--distributing information base B among K number of computers of a parallel computer system--we can process the task in parallel, with the aid of K number of processors, and in the following phase (in the serial or parallel mode) we can get the result of task M with the aid of algorithm C.

Let us illustrate what has been said with a simple example. Let us presume that the solution time for task M is a function of the quantity of input data n, in the form n^3. In this case, dividing the input data X - (x_1, x_2, x_3..., x_n) into two parts and applying algorithm A to these parts simultaneously we get the total time for processing these parts, which will be T_1 - $n^3/8$, leaving us T_2 - $7n^3/8$ time as compared tc full processing of the data X. If we can now define the linking algorithm C so that its running time is less than T_2 tjem. as a whole, we get an increase in the processing speed for task M in comparison with a single computer.

At first glance it may appear that the class of tasks requiring efficient parallel information distribution is not too great. In reality, however, this is not so at all. After defining the parallel information distribution operational mode, we carried out a theoretical examination of efficient realization of such common procedures as external information ordering and search in this operational mode. The basis for the evaluation was a model of a formal parallel computer system. In the case of the ordering procedure we got a K-fold value for the time saving, where K is the number of processors. The procedure of searching for the necessary information is one of the most common and most important procedures in information processing; in essence it can be reduced to the following: How can one find with appropriate identification the data stored on external carriers? In many practical tasks the search requires the greatest time expenditure, so the minimalization of the time for this procedure is a very timely question.

We examined the problem of information search in connection with parallel information distribution and we obtained theoretical time saving values approaching $K + K^2$-fold for parallel search in parallel computer systems, depending on the organization of the data and the mode of using it. It was shown that in many cases the use of parallel information distribution in parallel computer systems makes possible significant time savings even for a search performed in distributed information bases which have serial organization. By virtue of the simpler organization of the base this can be a starting point for a significant reduction in the size of the information base, while ensuring satisfactory time characteristics in connection with handling it.

The approximate theoretical values obtained for search time in parallel computer systems on the basis of the parallel information distribution operational mode show that there is a need for a detailed examination of questions connected with efficient handling of distributed information bases, depending on the organization,

structure and mode of use of the data bases. In the course of theoretical research on the parallel information distribution operational mode we obtained a number of interesting results in this regard which have practical significance. Naturally the efficiency of parallel information distribution is influenced by the extent of the information base to be processed, the complexity of the algorithm solving the task, as expressed in time expenditures, and the degree of interdependence among the sizes of the information base.

The theoretical research done in connection with the parallel information distribution operational mode shows that it is possible to use this operational mode to construct efficient information processing systems in an entire class of bulk information processing tasks, indeed to develop systems giving direct economic results. In processing systems giving direct economic results we developed systems based on parallel computer systems which, in contrast to processing done on separate computers, make possible not only substantial time savings but also cheaper processing.

An Experimental System

As an experimental test of the parallel information distribution operational mode and in order to develop sfotware supporting this operational mode in parallel computer systems we designed and built a parallel information processing system, the PIFR-1. We created the PIFR-1 on the basis of existing devices and software for ESZR [Uniform Computer Technology System] models with standard system development tools. This was done at the level of an applications program package expanding the OS ESZ possibilities suitable for parallel processing in homogeneous computer systems made up of ESZR models with channel-channel adapters and two-channel disks.

Operation of the PIFR-1 is based on the global-local control principle. In accordance with a formal model of homogeneous computer systems and a model of a parallel algorithm for the task (designed by a pre-computer) a concrete model of the computations was started on selected computers of the PIFR-1 system. Basic software of an individual computer controls the running of the programs For control purposes the pre-computer is connected with the processing process of the parallel algorithm, but only if situations arise in the individual computers which influence the course of the entire computational process. The global-local control principle not only made it necessary for the "nucleus" of the PIFR-1 to be present in every computer of the homogeneous computer systems but also ensured that the resident part of the system should not be proportionally too large (34 K), and made possible parallel organization of the execution of the PIFR-1, which significantly reduced the time expenditures connected with control functions in the homogeneous computer systems, improving the efficiency of the processing of parallel tasks under control of the PIFR-1.

The PIFR-1 consists of three chief parts: a parallel control program, a program taking care of information exchange between computers, and data structuring operations. Realization of programs for the PIFR-1 took place in the form of modules, with definite links between the modules. The modules are handled by the operating system in the multi-programming operational mode, which makes it possible to reduce waiting time to a minimum. Taking into consideration the purpose of the PIFR-1--as a test of the parallel information distribution operational mode--and the tools

needed to develop and test an approximation suitable for developing the appropriate parallel software, we have begun development of a PIFR-2 package, which is a substantial expansion of the PIFR-1 from the viewpoint of both its functional possibilities and tools for communication with the user. This makes it possible to use the package in the course of developing information processing systems built on the basis of homogeneous computer systems made up of ESZR models. One goal of the work in connection the PIFR-2 package was to make the functioning of the package more efficient.

Experiences in the development of the PIFR-1 and PIFR-2 packages not only made it possible for us to test the parallel information distribution operational mode but also made possible the development of a unique position in regard to the organization of basic software for homogeneous computer systems, one oriented primarily to such a parallel distribution operational mode. Thus in the course of developing a new approach to information processing using the parallel information distribution operational mode we designed and realized two parallel information processing systems in homogeneous computer systems.

On the basis of a theoretical examination of several aspects of parallel information distribution and on the basis of practical tests of parallel information distribution using the PIFR-1 and PIFR-2 systems, the user must be provided with developed software which ensures realization of the parallel information distribution operational mode in homogeneous computer systems (while maintaining an efficient interface between the user and the possibilities offered by the parallel information distribution operational mode). Starting from this we tried to outline a structure for parallel software for homogeneous computer systems in which the essence of complete software for parallel control systems will occupy a special place.

The development of a parallel control system corresponding to the basic concept of the parallel information distribution operational mode can be regarded as the development of a new method for parallel information distribution supported by general use programming tools--increasing the speed and efficiency of information processing. We should note that the use of such an escalation method in developing parallel software for homogeneous computer systems made it possible for us to develop, interdependent with one another, a number of aspects of the concept of parallel information distribution and the supporting software, thus decreasing superfluous testing and errors--in addition to the entire theoretical examination of the parallel information distribution operational mode.

Thus far we have not succeeded in carrying out an extended examination of the parallel information distribution operational mode on the basis of parallel information processing systems. But the experimental results thus far are positive and promising. For example, external ordering experiments done in the parallel information distribution operational mode in a homogeneous computer system consisting of two computers showed that the times used to perform the task on a single ESZ 1033 computer (T_1) and in a two-computer homogeneous computer system based on the ESZ 1033 (T_2) are related to one another as follows: $T_1 - 1.8\ T_2$. In this case it must be noted that the data to be ordered were placed on ESZ 5061 magnetic disks and if magnetic tapes had been used the difference would have been even more significant.

Even more time could be saved in parallel information processing systems by improving and making more efficient the system for information exchange. We are con-

tinuing our work in this direction. As I already mentioned above the functional distribution operational mode does not make possible, in bulk tasks, a time saving of K-fold or greater where K is the number of processors. In the case of parallel information distribution, however, such time savings can be achieved frequently, which could ensure the development of information processing systems giving direct economic results. An analysis of this problem has shown that in homogeneous computer systems consisting of K computers it is necessary to accelerate information processing more than K-fold in order to develop systems giving direct economic results.

What are those classes of tasks which should be considered primarily?

We carried out an analysis of book-keeping tasks for the purpose of selecting tasks which could be solved efficiently in the parallel information distribution operational mode. As compared to other classes of tasks these are considered the tasks which can be performed on computers with the worst degree of efficiency. As a result of the analysis we established that 80-85 percent of the tasks belonging to this class (as measured by time expenditures) consist of ordering and search operations. In addition, these tasks made possible distributed data handling at the level of initial data, intermediate data and output data alike (that is, putting the data in different computers).

Results

The approximate theoretical values obtained for the time for parallel search in parallel computer systems make it possible for us to speak of entirely realistic preconditions for the creation of high performance information search systems based on the parallel information distribution operational mode. This research is promising. A study of the development of efficient data base management systems based on use of the parallel information distribution operational mode is of interest also. Existing technical devices may limit the development of data base management systems using the new principle at acceptable costs for software development. This will make possible a significant reduction of all costs.

Data base management systems might be looked at in an entirely different way via the design of parallel type data base management systems. Structural problems for models corresponding to information search systems and data base management systems based on use of the parallel information distribution operational mode and an evaluation of the economic and operational efficiency of the models--from the viewpoint of designing them on the basis of industrial systems--have become important.

Another important problem area for practical utilization of the parallel information distribution operational mode is a subsequent determination of the class of tasks most appropriate from the viewpoint of realization in this operational mode and an expansion of the purely practical applications sphere for parallel information distribution for the purpose of a better understanding of the possibilities offered by it and making use of the results deriving from it.

A good bit of parallel developmental work is being done in the interest of more efficient use of parallel information distribution--improving the level of communication between the user and the parallel information processing system, a methodology

ensuring parallel distribution of tasks, and making the work of programmers using the parallel information distribution operational mode in developmental work more efficient.

Finally it should be noted that our publication titled "Parallel Information Processing and Parallel Algorithms" provides detailed information on the parallel information distribution operational mode, the parallel software being developed to support it, problems connected with this and the long-range prospects.

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COMPUTER DEMONSTRATION AT MINISTRY OF INDUSTRY

Budapest SZAMITASTECHNIKA in Hungarian Oct 81 p 6

[Article by Dr Ivan Szabo: "An Unusual Demonstration"]

[Text] "Debates here have become noticeably more substantive and of higher quality.... Those who undertake to call attention to errors and deficiencies for the most part do not introduce what they have to say with honor laps, many fewer speak in the language of flowers, sincere opinion has success and credit...." (Erno Keseru, "Viewpoint," MAGYAR NEMZET, 13 Sep 81.)

It was my first visit to the Ministry of Industry. It was the first because previously it was the building of the Ministry of Metallurgy and the Machine Industry, which I have visited many times before.

The demonstration took place at the beginning of the work day. I arrived early and so was witness to something unaccustomed--work began on time. A few of the workers of the ministry, in order to get to their places on time, ran the last few meters so I had occasion to see a few successful "final spurts" like those of true athletes trying to be the first to cross the finish line. I hypothesize that this was more than some formal phenomenon. The first condition for getting work done--naturally not an exclusive one--is to "occupy" the place of work.

But what other unaccustomed things happened on this morning? On behalf of about 60 experts they had organized a demonstration which might have borne the title "Computer Graphics in Technical Design in Hungary," at the initiative of a state secretary and outstandingly supported by the Desk Computer Special Group of the NJSZT [Janos Neumann Society of Computer Technology].

In the future state secretary Dr Laszlo Kapolyi will handle the geographic assignment of activities or networks of activities for thh purpose of scheduling or placing investment programs, doing so as a very important activity giving precedence to computerization. This idea gave birth to this program, where we could become acquainted with the new expectations and the organizational and computer solution methods for them, previously formulated for the experts and leaders of the new ministry. This can be called something new despite the fact that systems already operate in our homeland the tools and solutions of which are similar to the expectations of the state secretary in connection with a delineation of investment programs, and similar to the system for keeping records of investments running in the computer center of the VEIKI [Electric Power Industry Research Institute]. The

outlines of the solution have been worked out in connection with the data stored there also. But going beyond this we could also see special solutions for automated engineering design (AMT). The series of presentations and machine demonstrations given by the eight enterprises, each enterprise taking only a few minutes, reminded many of us of a well prepared artillery barrage. A barrage! Against whom and for what purpose? In my opinion it was in order to develop a new way of looking at the problem, in order to destroy the exclusiveness of the old batched view, for the purpose of ruffling its halo.

A large part of these tasks have already been to the wars and a number of small, medium and large computers with batch, on-line, real-time or time-sharing systems have been loaded with inadequate success. The results could be prepared only with impermissible delays, after a number of months, clumsily, without adequate vizualization, almost entirely ignoring the interactivity of task performance, uneconomically, inefficiently, without graphic documentation prepared synchronously which could be reproduced, etc. Restarting programs at will or reprocessing them took much time and still does because lacking adequate tools and an appropriate view it is not possible to change the insupportable situation which means that instead of (or lacking) local remote data processing systems, decentralized, interactive local or so-called endpoint-oriented ad hoc systems the jobs are "run" centrally, more correctly they "trudge" on our larger systems, unnecessarily burdening capacity which could be turned to other tasks--such as really large machine dual processor tasks.

What tasks? This is the other important idea which some of us have formulated already in our heads. If a large part of the tasks presently run could be "taken off" the larger machines--and, naturally, if there was a virtually unlimited availability of special purpose devices--then perhaps the "large machine" tasks could be reformulated and we might develop new, quality linkage systems between the computer centers and the places of work supported by computers. Perhaps we could move away from our generally outmoded, dusty solutions, whether the tools used are the best ESZR [Uniform Computer Technology System] or IBM machines. In my opinion we would soon find that the enterprises or users possessing computer technology information and outgrowing the frameworks of batched processing would reformulate their developmental ideas and these would then be permeated by a determination of a polarized demand and need.

A dream appeared even during the demonstration: How much simpler it would be to get a shipment to the proper place with a small cart, with suitable capacity and maneuverability, say to the shelf of a warehouse, than with a Boeing or Ilyushin airplane. And it would surely succeed, while this success is doubtful with a larger tool more suitable for different tasks. There was no need even to think through the economic and other effects and consequences.

It is not a new idea but rather a fundamental thesis of our profession that we should order the tool to fit the task and not vice versa. Has the time finally come when we will not be shooting sparrows with a cannon?

During the break someone said that 60-80 percent of the large enterprise tasks now on the computer at their place (he was talking about a concrete enterprise) could be "taken off" the computer now in use--which, in any case, is already 7 years old, and "creaking and rusty." And if they could get for this purpose in hard currency

one fifth of the forint sum intended for a large computer (or if a socialist device of equal value could be put in operation) and if the embargo limit were no impediment (in my opinion devices below the embargo level would be perfectly adequate in this case!) then what it would mean--and I don't discount it--in the life of the enterprise, in the development of their marketing possiblities, to use new computer technology devices and methods as a real tool. (It serves to excuse the users that use of domestic and socialist devices is limited not by a lack of demand but rather by the inadequate pace of development!)

What were those institutions which really used these devices finally as a tool, or which demonstrated their solutions?

The Ganz Electric Works: in the area of manufacturing parts by metal cutting, in putting together bids for electric trains, etc.;

The Ganz-Mavag Locomotive, Car and Machine Factory: in designing locomotives and motor trains, in designing pumps and turbines, in preparing bid documentation, etc.;

The Hungarian Hydrocarbon Industry Research and Development Institute: to evaluate drilling technology, geophysical and laboratory measurements, to plan operations, to model gas networks, to prepare large computer jobs and for algorithm research;

The Signal Technology Industry Research Institute: to design hybrid circuits, for measurement control and swift testing of large series circuits;

The Hungarian State Lorand Eotvos Geophysical Institute (ELGI) and the CORTEX Software Development PJT [Civil Law Association]: to develop a small computer terrain research guidance system, to prepare on the spot decisions for drilling activity, and to provide colored, graphic, three dimension depictions of coal fields and bauxite deposits;

The Survey Institute: to track artificial satellites, for general geodetic net calculations and computer depiction;

The Oil Plan: to calculate thermodynamic dimensions for petroleum industry distillation columns, to depict various physical conditions and geographic planning of pipelines; and

The Auto Industry Research Institute: to calculate optimal dimensions of large capacity internal combustion engines and for automatic testing.

The participants emphasized the practical utility of three dimensional function depicting software developed domestically (by ELGI and CORTEX) or by factories in the solution of tasks arising in various fields (technical, investment, engineering, etc.).

And what was unusual still?

They put together, in 10 minutes, and 10 minutes before the beginning of the demonstration, an HP 9845 C deck computer, which "cooperated" in this demonstration, with 200 K bytes of internal storage and a color graphic screen.

The speakers brought in their vest pockets programs and user program packages stored on minicassettes.

In 10-15 minutes we were told how the conditions for a 15 million dollar deal were fulfilled on a small computer and in the next 10 minutes we heard about more millions of dollars and tens and hundreds of millions of forints.

Would the whole thing be so simple?

If we think, select and decide well, if we decide in time, and if this is supported appropriately by higher echelons with the right of decision, then the answer, in our microprocessor world with a new view, is YES!

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DOMESTIC SMALL COMPUTER PRODUCTION

Budapest SZAMITASTECHNIKA in Hungarian Oct 81 pp 7-8

[Article by Karoly Stuka: "Domestic Manufacture and Use of Small Computers"]

[Text] Development of small computers began in our homeland in the second half of the 1960's in a number of institutions and collectives working largely independently from one another. It is not certain that the choice was deliberate, but it proved even on a world scale that the development of small machines was the most successful area. This may be thanks to the fact that the tools at our disposal made the development of computers of this size possible.

Essentially two successful and viable lines developed out of the many beginnings. We are calling one the PDP line and the other the CII line. In addition there are machine families which still exist and are developing (for example, the Vilati small computers). But despite their merits I do not regard these as determining factors in the development of domestic small computer manufacture and use.

The PDP line started at the KFKI [Central Physics Research Inscitute] with the development of members of the TPA [Stored Program Data Processing] computer family. The original meaning of TPA was "stored program analyser." In the course of developing and producing nuclear instruments--for example, manufacture of multichannel spectral analysers--the KFKI reached the level where it was able to develop universal small computers and manufacture them in small series. The first TPA computers, which in their architecture were adapted to the PDP-8 family, were followed by a TPA which had integrated circuits and then by the TPA/L and TPA-70 small computers, which used the same technological base but were no longer compatible with the PDP. (The TPA-70's are manufactured even today.")

The CII line is the result of another development. Its basis was the purchase of a CII-10010 computer license from the French CII firm. Originally the 10010 computer was a small computer designed for process control but it was used and is still used today for engineering calculations by a few domestic planning institutes.

The work connected with acceptance of the license was done by the SZKI [Computer Technology Coordination Institute] but manufacture was started by Videoton under the name VT-1010B. This was followed by the purchase (from the same firm) of the Mitra-15 license and, as a result of this, by the development and manufacture of the ESZ 1010 computer as part of the ESZR [Uniform Computer Technology System] cooperation. We can say with good reason that the purchase of this license created

the foundation for the domestic computer technology industry. The ESZ 1010, of which the VT [Videoton] manufactured several hundred configurations, was a very successful computer (a few even appeared under the name ESZ 1012, with an expanded instruction system). The great majority of the machines were exported. It may be that domestic users do not entirely share the opinion of foreigners but foreign users give it an unambiguously positive evaluation and, in this case, this is the final word. The Soviet Union is the biggest importer; VT computers are standard equipment, for example, in the dispatcher system of the electric power network covering the entire Soviet Union, for automatic control of oil and gas pipelines, in guidance systems for oil extraction, and in control systems for rail marshalling yards. Only well equipped, reliable computers at a high technical level can be used in such places--the VT machines meet these conditions. To ensure this, naturally, Videoton maintains a service center in Moscow with appropriate personnel and equipment.

The Present

Two types of computer technology manufacture exist in Hungary. On first hearing it appears that this should be condemned but in my opinion this is not so. The two types of manufacture differ radically from one another. The products of Videoton are primarily for export, primarily to the Soviet Union. Equipment produced economically in large series for large users is shipped in a few versions, but a small quantity also satisfies special and domestic needs.

Domestic needs are supplied primarily by computer technology manufacture taking place in the KFKI, where series size is sometimes 10 units while the institute is prepared to provide complete systems for needs moving over an extraordinarily broad scale. I do not say that this situation is the best but at least it is understandable. Especially if we consider a few peculiarities of our economic regulator system.

At present also the two developmental trends continue based on the two lines.

In the PDP line the KFKI has created the TPA 1140 computer related to the PDP-11/40 computer family. The present task is to create an advanced TPA 1140 model which extend "upward" the possibilities of the preceding machine. The EMU-11 minicomputer represents an extension of the 1140 "downward."

In the CII line, with the purchase of a new license, we have the ESZ 1010M and ESZ 1011 computers, which have a better price/performance relationship and offer a good bit greater performance than the ESZ 1010. Foreign demand in connection with the new machines is similar to the preceding period, perhaps because they have maintained the fullest possible compatibility with the ESZ 1010.

An interesting development at Videoton is the recent appearance of the SZM-52 computer, which can operate in both the PDP-11 and ESZ 1011 mode. In a number of applications it could be useful to realize with one machine the existing network operation based on the ESZ 1011 while using the existing technical calculations programs for the PDP machines in the local mode.

It is probable that the appearance of a third line will be a determining factor. We might call this a line of ESZR compatible small and medium machines. The

expression ESZR should be made more precise because the ESZ 1010 and the ESZ 1011 also are members of the ESZR, but they are not compatible with it. The new line is represented by the ESZ 1015 which belongs in the second series of the ESZR. It is expected that five or six units will be completed this year and manufacture is expected to start in a series of some tens of units. A larger series run will depend on the export possibilities, which will be clarified after 1984. By then the development of the advanced ESZ 1016 and ESZ 1017 models will probably be completed.

The picture would not be complete if we did not mention the microcomputer trend. But in this case we cannot use the expression "line," the situation is better expressed by "tangle"!

An immense number of microcomputers have been developed recently, about 100. The most significant are the VT20, the MO5X computer of the SZKI, the EMG-666 and 777, the MMT system created at the BME [Budapest Technical University], the MGP-80 computer of Textile Industry Research and many others.

The Applications Situation

The situation was very simple in connection with use-everyone used what he could, what he could get. The number of types of small machines brought into our homeland or created here is over fifty. The present situation is essentially defined by the KFKI. An ever increasing number of domestic users work with the various types of KFKI machines, and demand considerably exceeds the manufacturing possibilities of the institute. Today the ratio of domestic sales by Videoton is increasing as compared to earlier--primarily due to the spread of the VT20 systems.

The domestic applications picture would not be complete without the imported small computers. The PDP line includes the SZM-4 machines which can be imported from socialist countries and which belong to the MSZR [Minicomputer System]. Import of them began in 1980; a considerable number of machines arrived this year from the Soviet Union and purchases are expected from Czechoslovakia and possibly Bulgaria. The Elektronika-100 computers which can be acquired from the Soviet Union are compatible with these at the program level. In the years ahead these import machines may be the determining factor from the viewpoint of domestic use.

I do not mention the capitalist import machines because neither the economic nor the political situation make it probable that these will be available in larger numbers.

In the area of microcomputer applications the already colorful domestic palette will probably be varied even more by socialist import equipment, primarily by Robotron, which is conducting intensive market activity, and by Polish microcomputers, which have favorable features on the basis of samples but which can be handled only with reservations for well known reasons.

What Next?

We now arrive at what is perhaps the most sensitive point of the article. In what follows I have reviewed briefly the advantages and disadvantages (plus and minus) of the three existing lines mentioned.

The Line of ESZR Small and Medium Machines

Plus: Every advantage of ESZR cooperation can be used, there is a complete supply of peripherals and software.

Plus: It can be hypothesized that after 1985 there will be export market demand.

Minus: Domestic manufacturing traditions are completely lacking.

Minus: The export market does not stand out so strikingly from the other ESZR machines, as in the case of the ESZ 1010 and ESZ 1011.

The CII Line

Plus: The domestic manufacturing culture and tradition are significant.

Plus: The socialist export market is well established.

Plus: Demand at present is very strong on the socialist export market.

Minus: Thus far, basically, development has relied on license purchases.

Minus: At present one cannot forsee the prospects for sale of licenses.

Minus: An adequate domestic applications and reference background does not exist behind manufacture.

The PDP Line

Plus: There is significant domestic applications experience.

Plus: A domestic developmental background is ensured.

Plus: This continues to be one of the world's leading small computer trends.

Minus: Domestic experience with mass manufacture is lacking.

Minus: For the time being uniform technical policy coordination is weaker in MSZR cooperation than it is in the ESZR.

Minus: Basically the line depends on following prototypes, which involves risks.

As can be seen, the positive and negative aspects are about equal for all three lines. No one of the three is unambiguously better than the other two so on the basis of such a survey one cannot decide which to follow.

But a decision is needed.

The development of small computers, or the market, will not wait until we at home decide which trend to follow, and if we continue to be uncertain "the train will leave without us."

The resources at our disposal (on a national level) are not sufficient to follow all three trends. We face a forced decision at a high level.

In a forced situation a decision must be propitious rather than optimal, because it is very difficult to say what is optimal. Of the influencing factors the market policy factors will have the chief effect. At present the quality of Hungarian small computers and peripherals is the best on the socialist export market--it would be folly to abandon these market positions. The dark side is that domestic industry achieved this by making use of a quite high although not excessive capitalist productive import.

It seems a just requirement for the computer technology industry to bring the productive import needed for production at least into balance with its capitalist export. Opposed to this is the fact that at the level of the national economy it would be much more favorable to increase the export efficiency of other branches (for example, the food industry) by making use of computer technology equipment, because this would "bring in" many times over the foreign exchange needed for productive import. (This question requires further analysis.)

In evaluating the export markets the capacity of domestic industry is very significant also. The series size which appears the maximum attainable here would be so insignificant in the Soviet Union that it would not play a determining role there. We might seek a line to follow outside of the above three. Arguing against this is the fact that at present domestic software development capacity is not sufficient for the introduction of an independent, entirely new line. This would require significant concentration--and just the opposite can be experienced.

The only positive factor is that we have the developmental reserves for all three lines and it appears possible to start immediately a well paced development of any of them, after a decision is made.

It may appear that I have not mentioned the needs of domestic users among the determining factors. It is unfortunate that the level of domestic use does not reach a level, either quantitatively or qualitatively, to make it a determining factor for domestic industry. Domestic small computer applications still bear the signs of contingency, developments are scattered and take place independently of one another. Only in recent years have they started a few more comprehensive projects which may provide a guide for the domestic market in the next plan period.

Paths For Microcomputer Development

As I have mentioned already, one can best characterize the domestic development of microcomputers thus far with the word "anarchy." Central influence and coordination have been completely lacking, which may not be bad only from the viewpoint that trends which may become determining ones developed very freely.

A certain degree of concentration of development is indispensable in the future. Naturally I consider unimaginable any ban or central regulation. Certain preferences should be used to bring things together. This might be directed primarily at the following: united developmental systems; concentrated developmental capacity; a narrower but guaranteed accessible element base; and providing system elements made with mass manufacture.

The appearance of microcomputers means that the relatively well established boundaries of the computer technology industry have been washed away and the branch is becoming integrated with a number of other areas, for example with medical instrument manufacture, automatics, robot technology, telecommunications and signal technology, the instrument industry and there is no need to continue the list. This requires a serious rethinking and reformulation of technical development and industrial policy.

One element of central influence will be a research and development target program at the ministerial level, which is now starting under the title "Research and Development for Microcomputers and Their Applications Systems." The program prescribes relatively extensive central support, but much more significant are those enterprise assets which can be put in the service of a common goal in this way.

The developmental program prescribes the realization of certain goals in three categories--general use microprogrammed control equipment, microcomputers for technological process control and microcomputers for computer technology tasks. The most important goals are:

--Providing microcomputers, microcontrollers and microperipherals accessible in the OEM way for those putting together user systems;

--The possibility of access to developmental systems in commercial trade (it is frequently the case at present that a developmental system is developed for the first time in order to create a microcomputer system);

--Creating programming systems, languages and program libraries for microcomputers (in many places today program development for microcomputers takes place with ancient methods, in machine code or with primitive assemblers, at a very low level of efficiency);

--Developing applications model and reference systems (there is a very great need for these because microcomputers are being used by a much broader camp of users, less skilled from the viewpoint of computer technology, than used earlier devices);

--The above justifies a vigorous development of information, advice and education services; and

--The efficiency of developmental work must be increased by unification, standardization and specialization.

We hope that realization of these goals will aid the efficiency of developmental work, which is now scattered and uncoordinated, and substantially reduce the price of systems.

The organization of closer cooperation among CEMA countries in the area of microcomputers has been more vigorous recently. From the viewpoint of development this will certainly be of the same significance as it was when the ESZR cooperation began.

The Future of Use

As I mentioned already, in the area of applications we have not yet attained such success as in the area of developing and manufacturing small computers. The leap in the number of computers which is expected will surely lead to a qualitative change in this area also.

It is absolutely necessary that every aid necessary for use should be available to the users as a service condition. If there are very many users it cannot be imagined that the users will create everywhere their own service and software capacity.

Our present enterprise structure is not too suitable for such services. Various economic regulators must be used to help make the enterprises and computer technology institutions better interested in offering various services, so that they cannot make a living by selling machine time or delivering "naked" machines.

It might also be useful to create new organizational categories of users. I am not necessarily thinking here of the mushrooming PJT's [civil law associations], which rather remind one of a gold rush, although these organizational forms also will have a certain role in resolving present tensions. The developmental (engineering) enterprises and economic associations will probably be more stable institutions on which to rely when providing complex computer technology services.

We consider the creation of model systems to be very important in the area of applications development. These are already useful for concrete users and they offer a way for the developmental collective to master the special tricks of setting up systems provided and they can perform certain experiments in the area of developing optimal hardware and software configurations and working out applications methodologies. The central support provided to model systems reduces the risk accompanying such experiments.

In addition to the model systems for process control and engineering design, which can be regarded as classic, we consider it very important to create in the coming period enterprise guidance model systems working in the minicomputer distributed, on-line mode.

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RESEARCH IN PETROLEUM, NATURAL GAS VIEWED

Budapest NEPSZABADSAG in Hungarian 28 Jan 82, p 5

[Article by Gabor Pal Peto: "Visit in the Hungarian Hydrocarbon Research and Development Institute"]

[Text] In Szazhalombatta, on the premises of the Duna Petroleum Industry Company, the visitor's attention is captured by four long, narrow single-level buildings: the Hungarian Hydrocarbon Research and Development Institute (SZKFI) is situated here. The sign on the top of the first building is in many ways inaccurate, as told in the introduction by Sandor Doleschall, director.

Experimental Model Institute

--This is only the center of SZKFI, in addition to this facility, they have branches operating in 11 locations: in Budapest (several of them) Peterfurdo, Nagykanizsa, Szolnok, Szeged, Tatabanya, Miskolc. The Zalaegerszeg Petroleum Museum also belongs to us. This is explained by the creation of our institute. SZKFI was created 2 years ago by the National Petroleum and Natural Gas Trust from three former institutes. Among these: the High-Pressure Experimental Institute (NAKI) established for the hydrocrack research of the late Joseph Varsa, academician, was a research institute; the National Petroleum and Natural Gas Industry Research Laboratory (OGIL) was a company; finally, the Natural Gas Technology Research and Testing Station (KGVA) was one of the plants of OKGT. The regional research stations of these three institutes were also turned over to us.

Director Doleschall finds it more important that as far as its name is concerned the research and development institute is a company. It is the first, almost experimental, example of a new type of institution; a research and development company, which exists based on commissions from the industry, research performed to satisfy company requirements and related activities, such as procedure, device and instrument design. It has 920 employees, one-third of these have university degrees, but only a portion of them are designated as scientists; the designation was contingent on rather stringent requirements, e.g., language skills (skills, not examination!) and the acquisition of this designation motivates the young colleagues. The director finds the number of 38 researchers with doctorate degrees insufficient (although, SZKFI also employs a doctor of sciences and 16 graduate-level researchers): they strive for the type of achievements that beside being of primary significance for industry and the economy are also scientifically recognized.

--We measured up the accomplishments of our institute during the past 5 years and those of its legal predecessors and found that approximately 70-75 percent of our results were introduced by industry in a year, and approximately 85-90 percent in 3 years. This may appear nice--in my opinion too nice--, since the remaining 10 percent is too low for us to be able to maintain the same ratio. Because in addition to the necessary failures, this portion includes those long-term tasks which will not come to fruition for several years.

Underground

Instead of discussing the ambitiously but carefully planned future tasks, I attempt to discuss with the directors of the four branches some typical examples of current accomplishments.

Janos Kokai, director of the mining branch employing one-third of the personnel of the institute, mentioned that their diversified activities are closely connected to the long-range plans of national petroleum exploitation:

--The laboratory examinations of rock samples taken from domestic hydrocarbon research drilling are done in the institute. These are extremely important for hydrocarbon research, the determination of hydrocarbon assets of already discovered deposits and for the preparation of exploitative plans securing a large final return.

We developed computer programs in our institute to model processes taking place in certain petroleum and natural gas deposits. These allow to judge how pressure and water afterflow (as a nautral squeezing power) will vary in deposits found in porous or fissures rock formations situated several hundreds or thousands of meters underground.

As an example, let me mention that we expect a 43-47 percent final retrieval with the exploitation conducted based on our plans at the most important domestic deposit (in Algyo); this has already been confirmed by the results so far. The economic significance of this can only be seen if we know that, according to the world average, only 25-30 percent of the initial petroleum reserves can be exploited; the rest remains underground as a result of complicated physical and chemical forces which act against exploitation and which dominate the petroleum-rich rocks.

In addition to this, we are involved in many other tasks connected with hydrocarbon exploitation. We are conducting organic chemistry examinations to become more familiar with the perspectives of national hydrocarbon exploration. The so-called secondary and tertiary procedures serve to further reduce the quantity of petroleum left in the deposits: research of carbondioxide, underground burning and future chemical (micellar) methods.

I have only touched on a few areas of activity and said nothing about the geophysical, sludge drilling and cement research in our branch, whose results will all be used by industry.

The success of our activity is greatly enhanced by the fact that we regularly discuss our research results with technical leaders of IKGT and experts of the

petroleum producing companies and agree on the steps necessary for industrial implementation.

The End Is Not a Report

Following the conversation with Janos Kokai, let us trace the path of petroleum and natural gas brought to the surface; perhaps in an unusual manner, let us begin with natural gas.

Istvan Hajdu, director of the natural gas industry branch of the SZKFI, reminds us of the fact that in the past two decades the natural gas consumption in Hungary has increased 30 times; today almost one million households use gas in about 150 cities and communities, and, in addition to this, 2 million and 2 hundred thousand households use propane-butane gas tanks; i.e., 75 percent of all Hungarian households are supplied with gas.

Research connected to the extension of natural gas use is diversified. For instance, gas enters homes at a very low pressure. This is something left over from the time when gas was used for lighting and corresponds to the state of the art at that time. Today, however, this is not only unnecessary but is also disadvantageous. The method has been developed which does not interrupt the medium-pressure gas flow at the outside walls of homes but allows it to continue into the home as well. This way, gas can be more efficiently burned, and the large and thick-walled ugly pipes become unnecessary; a sufficient amount of gas can be supplied through narrow pipes and the others can be hidden. This system was tested in Ingolstadt, in the Federal Republic of Germany, and achieved a savings of DM 900 per household during installation. In Hungary, too, after overcoming many difficulties, the new natural gas-supply design is gaining ground.

Another interesting research task is the modernization of propane-butane (PB) gas use. To extend its use from cooking to hotwater and home heating, first we must produce and authorize tanks larger than the well-known gas tanks. This was finally accomplished as a result of several years effort. The other problem is that butane gas has a lower gas pressure and, as a result, does not come out of the tank in the winter or in cold locations; it cannot be used and is lost. In certain situations, it would be beneficial to use pure propane gas. But what about butane gas then? In cooperation with the Ganz Electrical Works the researchers developed a burner which could also burn liquid gas, i.e., even pure butane. The utilization possibilities of national natural gas occurrences contains neutral (inert), nonburning gases--nitrogen, carbondioxide--are also being studied. But the scope of their activities involves even gas equipment, for whose inspection they are responsible, thus observations made find their way back to the manufacturers. Or they study gas flow dynamics--with computer simulation--which is important during the installation of new consumers.

Petroleum research is handled by two branches of SZKFI: petroleum processing, headed by Gyula Gati and technical and technological research, headed by Lajos Zalka.

Describing the diversified research activities, Lajos Zalka is proudest of two things: one of them is very small and the other, very large. The small one: the experimental laboratory reactor system which won an award several years ago

at the Budapest International Fair. This equipment was originally developed to support their own research goals; it allows them to simulate in 100-milliliter volume the catalytic processes taking place in the gaseous and liquid states. Ultimately, there was so much demand for this equipment both domestically and abroad that they were unable to produce it in sufficient quantities; so production rights were turned over to the FOK-GYEM cooperative which exports 20-25 units yearly of the various models, while they are devoting their attention to further development. The very large one: two partial plants built in Peterfurdo in collaboration with the Danube Petroleum Industry Company. Based on individual initiative and commissioned by Fuzfo Nitrochemistry, they developed the production technology for a compound (intermediary) necessary for the production of two insecticides.

--In connection with the conflicting results down between the research institute and industry, my opinion is that the obstacles are caused by increased dimensions --emphasized Lajos Zalka.

--In my opinion, the only possible way is to entrust the research institute with the establishment of the experimental partial plant. In this particular case, with the consent and support of our superiors, we could build the two semiplants --4000-ton with an annual or 1000-ton capacity per year. We took full responsibility for them from design to implementation; this was part of the reason why we managed to complete them in 2.5 years, which is a national record. After the successful completion of the experiment--during which we delivered in significant quantities and flawless products to industry--we turned over the plants to the Danube Petroleum Enterprise, and, at the same time, started the development of new procedures.

But maybe this is not the only possible way to development--adds Lajos Zalka later. A plant is now under construction in Fuzfo, using our achievements and our expertise. From our own experience, I can say that a research project that ends with a report is in most cases a failure.

Oil Change Every 12000 Kilometers

The branch headed by Gyula Gati is involved with petroleum processing, production and product development. Lubricating oils, machine grease, fuel, pharmaceutical and insecticide intermediaries, special materials, e.g., temporary and permanent anticorrosion materials (for car frames): this is an extremely diversified branch.

--Gyula Gati mentions that presently production of fuels is taking place in several refineries, using various technologies and with the production of various products. Coordinating this complicated system to make it optimal for the country is nearly impossible. We developed a computer model for it, commissioned by OKGT, and, according to estimates, this optimized management system results to gain several hundred million forints extra profit.

In an industry of this size, minor variations can produce enormous results: e.g., in gasoline reforming--in whose research we have been involved for 15 years--even one percent extra extract means 10 million forints.

Presently we are doing research for a 1-million-ton cracking plant being built by DKV. The plant--in which we crack heating oil molecules (to gasoline and gas oil) knows many "tricks," e.g., the utilization of the side products created, processing of the petrochemical products. We are developing original procedures using laboratory equipment for these and the production of insecticide and pharmaceutical base materials to induce export to capitalist countries. To automate them, we are beginning to use--currently only in-house--microprocessing and computerization. In the designing of the plants based on our new procedures, we are collaborating with the Petroleum and Gas Industry Planning Enterprises.

Since we live in a car-oriented country, fuel and lubricants are of interest to many of us. In closing let me mention the following: our experiments have determined that using domestically-developed lubricationg oil, the oil-change cycle can be increased to 12,000 kilometers; trucks went for 100,000 kilometers without an oil change. The significance of this for the national economy and private automobiles can be easily understood.

*

Last year, the Ministry Council put great emphasis on the significance of research and development companies in dealing with the development of the scientific-research institute network. This is another reason why the activity of this institute deserves attention.

9901
CSO: 2502/41

SCIENTIFIC PROBLEMS VIS-A-VIS ECONOMIC CRISIS ASSESSED

Warsaw TRYBUNA LUDU in Polish 15 Jan 82 p 4

[Article by Zdzislaw Kaczmarek, scientific secretary, Polish Academy of Sciences: "Science During the Period of Overcoming the Crisis; Problems and Discussions"; passages enclosed in slantlines printed in boldface]

> [Text] Polish science has found itself in a distressing situation, one which demands that many viewpoints be revaluated and that a new, constructive program be prepared. The prolonged socioeconomic crisis which is afflicting our country has left its mark on it and the need to solve other burning problems does not permit the political authorities to treat science as a priority area at this time. It will be necessary to limit the scope of research and to adapt its subject matter to the most critical social needs. It will take many years of intensive work to make up the backwardnesses that already exist and that continue to arise. At the same time, in view of the difficult situation of the State and the economy, the scientific community faces new obligations and increased responsibility for Poland's future.

The imposition of martial law has halted the rapidly growing process of the disintegration of the State and the economy. However, the restrictions that result from martial law are burdensome for creative-type communities and cause serious controversies. The possible prolongation of the period of isolation of Polish science, and particularly difficulties in taking advantage of international exchange of scientific-engineering ideas, may have negative consequences. There are rumors that in some countries boycotts are being organized against cooperation with Polish colleges and institutes.

Superficial Generalizations

These are objective circumstances and they cannot be fully solved in the immediate future. However, the subjective preconditions for the functioning of Polish science, arising from the ambiguity-tinged relations in the triangle: society, State authorities, scientific community--arouse just as much distress. It must be said candidly that we are not at all without fault here. During the decade of the 1970's, a representative portion of the scientific community sanctioned by its authority the faulty economic decisions that brought Poland to the brink of catastrophe. It is not surprising, therefore, that a part of society and large circles in the State administration show a lack of confidence in scientists.

The August events released justifiably critical reactions in the intellectual circles. But they were accompanied by overly histerical manifestations of expiation as well as by attacks by the political opponents of socialism on all of the economic, scientific and cultural achievements of the postwar period. Cries were heard, with no factual basis, about the universal crisis of our social system, including also Polish science. All of this has an adverse affect on reinforcing the credibility of science and its representatives in the eyes of the public.

On the other hand, however, the intellectual circles are the object of superficial generalizations. The linkage of the extremal political tendencies among "Solidarity" activists with the attitudes of some of the workers in science and culture who oppose socialism, has, here and there, created a tendency to identify all of the creative-type intelligentsia with the antisocialist ideological current. This is a one-sided and false picture. During the entire post-August period, a considerable part of the scientific community spoke out in favor of the socialist path for Poland's development and furthermore, through a system of consultation and implementation of research tasks, wanted to serve the constructive positions and actions which would assist in finding a way out of the crisis. However, these activities were not properly displayed and their effectiveness was restricted by political tensions.

The Search for Solutions

Frustration in the scientific community, lack of public confidence, and a resentful, in large part, power apparatus--this was the configuration that, indeed, augured the worst. /The primary need right now is to conquer the prejudices that have arisen, and to place mutual obligations on the parties involved--obligations which arise from the obvious necessity to include all of the nation's creative forces which favor socialism in the activities which will assist in overcoming the critical events./

It is the obligation of our community above all to shape the attitudes of rational thought and to search for solutions which will be particularly useful in:

/--reconstructing social attitudes, and principally increasing the influence and responsibility of the young generation of Poles for the fate of the fatherland;

--changing the economic mechanisms and methods of managing the State and social life;

--adapting the structure of the economy and technological solutions to the raw-materials' capability and cadre potential of the country./

The participation of science in preparing economic reform and in developing forms of collective life should assist in the practical accomplishment of these goals. National agreement in Poland must be based on scientific principles of the organization of social life, free of fortuity and all kinds of voluntarism.

/Research problems of the 1980's must be adapted to the above-mentioned social goals. This will require a deep reorientation of the activities of many scientific groups,/ and particularly those that were directed at solving problems that coincided with the erroneous economic concepts of the past decade. The problem of correctly choosing the subjects of research was always one of the critical points of our scientific

policy. Solutions here must come from the cooperation of the scientific community with the representatives of industry and they should be based on the long-range program for the country's socioeconomic development.

During the next few months a review should be made of the centrally controlled research programs and their number and scope should be limited to the sizes that are realistically justified by the need for increased coordination, based on objective financing.

/In expanding scientific activity for practical needs, we must observe the necessity for conducting basic research, whose results not only constitute a lasting contribution to our culture and raise Poland's prestige in the world, but also make it possible to create original theories and methods indispensable for future applications./ Based on international experience, we should require that at least one-sixth of the funds and the cadre potential are committed to basic fields of research. In this way we will show proof that we are thinking responsibly about the future.

No one in our country doubts today that the key to Poland's future rests in the hands of the working class. I believe that the party to which I belong has not been able to find effective ways of bringing creative intelligence closer to the workforces of the large, industrial plants, leaving this area of activity to our political opponents. It is obvious that /the scientific community should support the working class in its striving to improve the efficiency of the economy, for social justice, and for improvement in the socialist relations of production./ In performing a service role to society, science must, at the same time, avoid the appearance of servility towards the authorities; it cannot be patronizing, as has happened frequently in the past.

At this point some thoughts occur on the state of the social sciences. Because I am engaged in another field of research, I can evaluate its state solely from the position of an outside observer. But it seems that in considering the critical events in our science they should be perceived precisely in this field--primarily in view of the lack of a close connection between the development of social sciences with the actual needs of the shaping of the socialist sociopolitical system. Errors in the party's scientific policy, which were of long standing and had various roots, and the attitude of part of the party circles of the social sciences, were decisive here. Preparation of a detailed analysis of the situation in the social sciences and a program for overcoming these deficiencies, is indispensable.

Making Use of the Potential

/In order for Polish science to develop and properly accomplish the tasks which it faces, specific conditions must be fulfilled. It is the duty of the State authorities to ensure these conditions, within a reasonably justified range, even in times of economic crisis./ For the crisis cannot be overcome unless the scientific potential is properly utilized. The most important problems include:

/ 1. Maintaining for the next two to four years the present technical level of the research centers by ensuring them the minimum funds for renovating scientific apparatus and keeping it in operation; after this period, a fundamental modernization of the research facilities will be indispensable, so as to at least in selected fields adapt them to the average world level.

2. Ensuring the highest priority for a regular flow to Poland of information on world scientific achievements, primarily in the form of importation of periodicals and books.

3. Ensuring a lasting perspective for the operation of valuable research groups, creating a guarantee for continuity of research, protection against the negative effects of periodic fluctuations of the economic situation, and support for the development of distinguished Polish scientific schools--irrespective of whether they are involved in basic or applied research.

4. In view of the prospects of a reduction in funds for research by the industrial enterprises operating in the new economic system, increasing, during the interim period, the share of the State budget for financing work that advances scientific-engineering progress in the national economy.

5. Maintaining by Poland scientific cooperation with leading research centers in socialist and capitalist countries and with unions and scientific societies; the organization of boycotts of cooperation with Polish science, often inspired by Polish emigration circles, should be resisted.

6. Developing self-governing forms of organizing scientific life, shaped by many years of tradition, and giving them broader powers in matters of research initiatives, selection of methods, assessment of value and integrity of results, and in the field of training scientific cadres, while at the same time guaranteeing the State's influence on the implementation of social goals of scientific policy.

The primary goal of these actions is to bring about a state in which the important, certainly, intellectual potential of Polish science will be properly utilized./ In past practice this was not possible due to the lack of a long-range coupling of economic intentions and research programs, and a simultaneous lack of motivation for cooperation of scientific circles with industrial organizations. The lack of efficiency in scientific facilities was caused also by the serious technical backwardness of many research shops.

I repeat again that the thesis, promoted during the post-August period, that there is a general crisis in Polish science, does not withstand criticism in confrontation with the actual facts. A number of fields have expanded and obtained meaningful results, which have also been recognized outside the borders of our country. Today it is most important that we use these achievements to make it easier for us to extricate ourselves from Poland's critical sociopolitical situation.

The Role of the Polish Academy of Sciences

In conclusion I wish to make some comments regarding the Polish Academy of Sciences. The controversies surrounding its role in Polish science have persisted as long as the Academy exists in its present form. In any case, they have deepened during the last several months. We have even heard from those who would like to see the Polish Academy of Sciences as a platform for political discussion between the intellectual communities and the State authorities, giving its actual scientific functions a secondary importance. We cannot agree with such a position.

The acceptance, during the First Congress of Polish Sciences, of a three-element model of the Polish Academy of Sciences: a self-governing society of scholars, a State center for basic research, and one of the organs of the State's scientific policy, provoked a great deal of resistance, especially among the scientific administrations of the higher teaching institutions who feared the Academy's special position in the area of basic research. This opposition arose partly from the overly traditional understanding of the tasks and structure of contemporary science and the underestimation of the need to concentrate large forces and means on research, particularly experimental, which exceeds the capabilities of the teaching institutions. In part they are also the result of mistakes made in forming the network of Polish Academy of Sciences centers, consisting of creating independent centers in those fields also which could have been properly pursued by the college groups. Some of these decisions should be reexamined, mainly in relation to social sciences.

To Contribute to the Development of Science as a Whole

/The Academy intends to continue to conduct research in selected fields and to assist the development of Polish science as a whole, but it does not claim to manage it administratively in any form. If we feel a responsibility to stimulate, coordinate and jointly finance basic research, it is primarily because the Polish Academy of Sciences has available to it, as the only institution in the country, a uniform, encompassing all fields of science, system of scientific committees, assembling several thousand scholars from higher schools and institutes. We want to strengthen the representative character of this system and to enlarge the scope of its authority, thus creating a democratic and self-governing platform for shaping the opinions and decisions concerning the most important problems of Poland's scientific life.

The Polish Academy of Sciences is one of the institutions of a socialist society which assists in its intellectual and economic development./ Discussions on the new form of the law on the Polish Academy of Sciences contribute to the improvement of its structure and form of action. We base our activities on the traditions of Polish science and on the achievements of contemporary researchers. /In our concern for the development of science and the right to be free to search creatively, we are also making our intellectual potential available to society and the political authorities.

This competent and collegiately organized group of scientific advisors is ready to take an active part in solving the difficult problems facing Poland./

9295
CSO: 2602/12

ACTIVITY OF CENTER FOR AERONAUTICAL MEDICINE DISCUSSED

Bucharest REVISTA SANITARA MILITARA in Romanian No 4, Oct-Nov-Dec 81 pp 477-480

["Data on the Historic Center for Aeronautical Medicine," by Dr Corneliu Ionescu, Medical Colonel Dr Marin Anton]

[Excerpts] Established on 6 August 1920, the Center for Aeronautical Medicine in Bucharest is one of the few institutions of its kind in the world.

Today the Center for Aeronautical Medicine has a modern material base, a new multifunctional building, examination equipment representing, for the most part, the latest achievements of specialized technology. Some devices and means of investigation are original; they have been constructed in Romania according to the directions of doctors and psychologists from the Center for Aeronautical Medicine. The center's laboratory for functional studies, the laboratory for psychophysiology, the clinical laboratory and the vestibulometry laboratory use highly perfected methods of investigation and are equipped at a level which places them among the best laboratories compared with those in similar institutions in other countries.

Examinations in the area of aeronautical medicine are executed in a creative manner by tireless scientific research work, reflected in works compiled and published in various reviews in the country or communicated in symposiums, conferences or international congresses. In addition, the scientific collaboration with specialized institutes of the Academy of the Socialist Republic of Romania, with the clinics of the Ministry of Health and with the clinical sections of the Central Military Hospital has been enriched considerably. Also, the Center for Aeronautical Medicine participated actively in the medical selection and training program of the Romanian cosmonaut candidates in 1978.

The continued perfecting of the techniques of investigation and professional training, as well as political and ideological training, are the objectives of the personnel of the Center for Aeronautical Medicine, which, in the final analysis, are reflected in the good results obtained in ensuring the medical safety of flight.

CSO: 2702/3

BRIEFS

MOLECULAR GENETICS INSTITUTE IN SPLIT--It has been decided that the International Institute for Molecular Genetics will be housed in the "Dalmacija" villa in Split. This was discussed on Thursday at a meeting of the [Croatian] Republic Committee for Science, Technology, and Information in Zagreb. A special council of the Yugoslav Academy of Art and Science and the University in Split, the founders of this institute, made this decision, thereby providing Yugoslavia with a high-level center for molecular genetics which would be assisted financially and professionally by international scientific organizations and which would be headed by our specialists who have been recognized and are now working abroad. [Excerpt] [Zagreb VJESNIK in Serbo-Croatian 5 Feb 82 p 12]

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END

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East Europe Report

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Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 3, 1981 pp 77-83

[Article by Prof Dimitur Mishev: "'Spektur 15' Aboard the 'Salyut-Soyuz' Manned Orbital Scientific Research Complex"]

[Text] In connection with the flight of the international crew involving the first Bulgarian cosmonaut Georgi Ivanov, a scientific program and proper equipment for the telemetric study of earth from outer space had to be developed. This is one of the lines followed in space research, in which our country traditionally has been working and in which it has achieved some success and recognition. Let me point out that the telemetric observation of earth from outer space means observations and measurements of energy and polarizing characteristics of specific and reflected radiation of the earth's land, oceans and atmosphere in the various ranges of the electromagnetic spectrum, which help to determine the location, nature and temporal variability (dynamic) of natural parameters and phenomena, the earth's natural resources, the environment and anthropogenic sites and formations.

The scientific program of the flight of Col Engineer G. Ivanov included the following studies and experiments: Balkan, Contrast, Atmosphere, Horizon, Dawn, Porthole, Halo and Biosphere-B. Let us describe briefly the basic research assignments.

Balkan. Simultaneous spectrometry and multiple-spectral photography of homogeneous land and water surfaces. This was accomplished with the help of the multiple-channel Spektur 15 spectrometric system developed by Bulgarian scientists and the multizonal MKF-6M photographic camera developed by scientists from the USSR and the GDR. The objective was the following:

Obtaining multispectral data for the various sciences and economic sectors;

Modeling some future studies with complex scientific equipment for the B-1300-2 project;

Developing methods for the coordination of simultaneously obtained spectrometric data and multizonal images and their processing.

Contrast. Despite the steps taken to reduce atmospheric pollution, the problem of pollutants which occasionally reach dangerous concentrations (particularly those close to large industrial centers) is becoming serious. The rapid development of transportation systems and the intensive growth of industry are raising the level of atmospheric and water pollution and particularly that in large centers of modern civilization. So-called "pollution domes" appear.

Studies are underway of changes in the transmission function of the atmosphere depending on its level of pollution over large industrial centers not far from water basins. This is conducted with the help of the Spektur 15 multichannel system and a camera with polarizing filters.

The main scientific tasks are the following:

Study of changes in the frequency characteristics of the transmission function of the atmosphere according to atmospheric pollution data;

Study of spectral deviations of the transmission function in different types of pollution;

Study of pollution dynamics of coastal waters caused by industrial waste carried by the currents;

Grading large centers by type and structure of pollutants and comparing the spectra of their transmission functions;

Study of the possibility of breaking down basic pollutants by type according to their influence on the spectral optical characteristics of the atmosphere, etc.

Atmosphere. The characteristics of solar radiation and the radiation of natural formations are used in the study of natural resources on earth from outer space. Since solar radiation and the radiation of earth objects are transformed as they cross the atmosphere, the influence of the atmosphere and atmospheric effects must be taken into consideration in the study of natural formations (and resources) from outer space. The transformation of radiation in the atmosphere is related to the absorption and dispersion of electromagnetic waves as atmospheric gas components and aerosol particles. These processes change the spectral, angular and spatial dispersion of radiation. Furthermore, as a result of the dispersion and the radiation of the atmosphere itself, a background is added to the radiation or reflective radiation of objects, which also distort the spectral, angular and spatial structure of the initial signal of the studied target and which also provide information on the atmosphere itself. Atmospheric effects can be determined with the transmission function of the atmosphere.

The purpose of such studies is the following:

To determine the transmission function of the atmosphere from outer space;

To study the optical characteristics of the atmosphere on the basis of the determination of the angular structure of radiation of the spectral reflection coefficient of the earth and the measurement of the reflected solar radiation from the earth's surface at two points symmetrical in terms of their nadir.

The studies are conducted with the multichannel spectrometric Spektur 15 system. A possible deviation of its optical axis by ±10° compared to the nadir on the level of the flight is considered.

Horizon. The purpose is to study the optical characteristics of the earth's atmosphere based on the spectral programs of the setting sun and the terminator zone.

The scientific tasks of such studies are the following:

To study the possibility of determining the transmission function of the atmosphere based on spectrometric data of the setting sun until the sun has entirely disappeared over the horizon;

To study the spectral characteristics and the indicators of the dispersal of the light from the earth's atmosphere based on data obtained by Spektur 15 in the area of the terminator in nadir.

Such studies are conducted with the help of Spektur 15.

Dawn. The purpose is to study solar radiation dispersed by the atmosphere during sunrise or sunset and to obtain important data from the atmospheric structure. Furthermore, the coefficient of atmospheric permeability must be computed and the earth's horizon at sunset and during the night must be analyzed spectrometrically.

The Spektur 15 system is used for these purposes and the station is oriented in the direction of the sun.

The study known as Terminator was conducted with the help of the Spektur 15 system in some flights of international crews based on the Intercosmos system (such as Vietnam, Mongolia, etc). The purpose was to study the optical characteristics of the atmosphere based on spectrometric data in the terminator zone.

Porthole. We know that the information obtained from the study of the earth and the processes around the earth from outer space is unique. However, such observations are complicated by conditions prevailing in outer space. For example, some cosmonauts have noted a darkening of the portholes immediately after the space ship was put into orbit. This means that the data obtained and recorded aboard the ship through the portholes of Salyut 6 were somewhat distorted. This prevents the quantitative processing of the data and of multizonal images and greatly reduced the effectiveness of their use for scientific and economic purposes.

The Bulgarian scientists suggested a method for determining the optical characteristics of a randomly selected porthole with the help of the multichannel Spektur 15 spectrometric system.

The scientific assignments of this study are the following:

To determine the spectral coefficient of transparency of the portholes in space flight;

To determine the dynamics of change of the spectral transparency coefficient during long flights;

To correct obtained data and multichannel images obtained aboard the Soyuz 6, taking into consideration the real effect of the respective portholes;

To use such data in designing the portholes of subsequent orbital stations.

Halo and Biosphere-B, which are the last two groups of studies, are not directly related to the Spektur 15 multichannel system, for which reason we shall not discuss them in this article.

The Spektur 15 multichannel spectrometric system was developed, built and delivered after a complex cycle of testing by a Soviet acceptance commission for use in the large and important scientific program being implemented in the area of telemetric studies of the earth from outer space. The system is a product of Bulgarian science and technology. Its purpose is to obtain and record data concerning the properties and effects of radiation within the visible and close infrared range of the electromagnetic spectrum, whether specific or reflected by various natural formations and the atmosphere. It permits the operating cosmonaut to make verbal comments and to record sound signals digitally (through delta modulation).

The system consists of the following installations: Spektur 15 K and Spektur 15 KR.

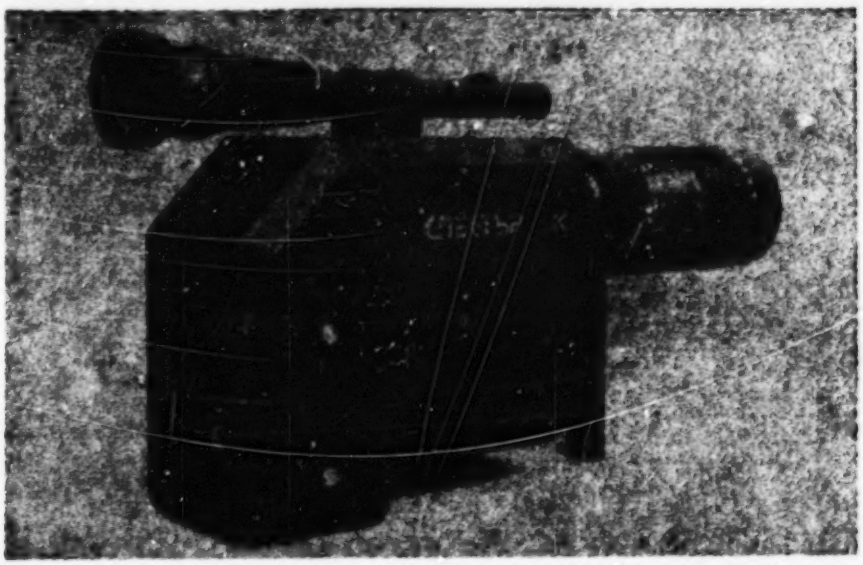
Spektur 15 K is a multichannel spectrometer with a digital output. It has 15 channels with a 20 nm band width. A lens with a 300 mm focal distance, 1:4 aperture and 8° angle of vision is used. The dispersal system is a reflecting diffraction grid (600 lines per mm). It is used for the optical electronic transformation of the linear semiconductor structure with phototransistors which operate under a charge accumulation system. The scanning along the wavelength is electronic; along the length of the flight it is achieved by the motion of the space ship. The analog-digital conversion time is under 20 micron seconds. An 8-grade code is used. Spektur 15 K can be secured to the porthole of the Salyut 6 orbital station with a special braket or else held by the cosmonaut. The bracket is so designed as to allow changes in the position of the instrument on the level of the flight at ±10° of the nadir. This makes possible the studies planned for the Atmosphere series: eliminating the influence of the repeated dispersal in the atmosphere and determining the reflection indicator. If the instrument is secured to the porthole, the optical axis of the lens and the aim of the Spektur 15 K become coincident with the main optical axis of the IKF-6M multichannel camera (this is necessary for the studies of the Balkan series and for correcting some specific effects of recording the images by the MKF-6M). The initial models made it possible to change the reaction to light with the shade of the lens up to 32 times. Light overloading is indicated by a flashing light on the control panel and the viewfinder of Spektur 15 K.

Spektur 15 KR is used in registering digital data received through the input bars, control of all work systems of the digital cassette recorder, the analog-digital transformation of the sound signal and connection and synchronized work with the control and measuring equipment (KIA). It contains the second power block of the entire system. The digital data are recorded on magnetic tape at the speed of 8 K bits per second with a recording accuracy of no more than one error per 10^7 bit.

A working copy for the preflight training of the crews was developed along with the Spektur 15 system. It was installed by Bulgarian specialists in the simulator of the Salyut 6 orbital complex at the end of 1978 and is still being used in the training of Soviet and international crews.

In February 1979 the Soviet state acceptance commission accepted the Spektur 15 flight and spare sets. The system consists of separate blocks which could be put into orbit separately and subsequently assembled and tuned on board the Salyut-Soyuz orbital complex. The Spektur 15 KR block, lens, optical sight, bracket and neutral fliters were put in orbit with the Progres 5 transport ship in March 1979 (the ship was launched on 12 March 1979 at 0847 hours and linked with Salyut 6 on

14 March 1979 at 1020 hours). The remaining parts, such as the Spektur 15 K system and the digital data recording cassettes were carried by cosmonauts N. Rukavishnikov and G. Ivanov in the Soyuz 33 space ship. Considering the dramatic circumstances of the heroic flight of the night of 11 April 1979, the decision was made at the Flight Control Center that the other systems would not be brought down to earth, for which reason a new Spektur 15 K system, compatible with the remaining complex blocks of the system aboard the Salyut 6, had to be made within an extremely short time. All remaining blocks were put in orbit in May 1979 with the Progres 6 transport ship (launched on 13 May 1979 at 0717 hours, and linked with Salyut 6 on 15 May 1979 at 0919 hours). The Spektur 15 multichannel spectrometric system was assembled, tuned and made ready for work in orbit in a short time. This was accomplished by cosmonauts V. Lyakhov and V. Ryumin. In implementing their international duty, they undertook the fulfillment of the complex scientific program which had been drafted for the Rukavishnikov-Ivanov flight. Studies within the Contrast and Terminator series were conducted on 27 June 1979 during the 10,049th orbit of the Salyut-Soyuz scientific complex; on the following day--28 June 1979--orbiting over Saudi Arabia and later on Kamchatka, on the 10,169th and 10,172d orbits, the studies of the Porthole, Dawn and Contrast series were conducted....This marked the start of the Bulgarian scientific program.

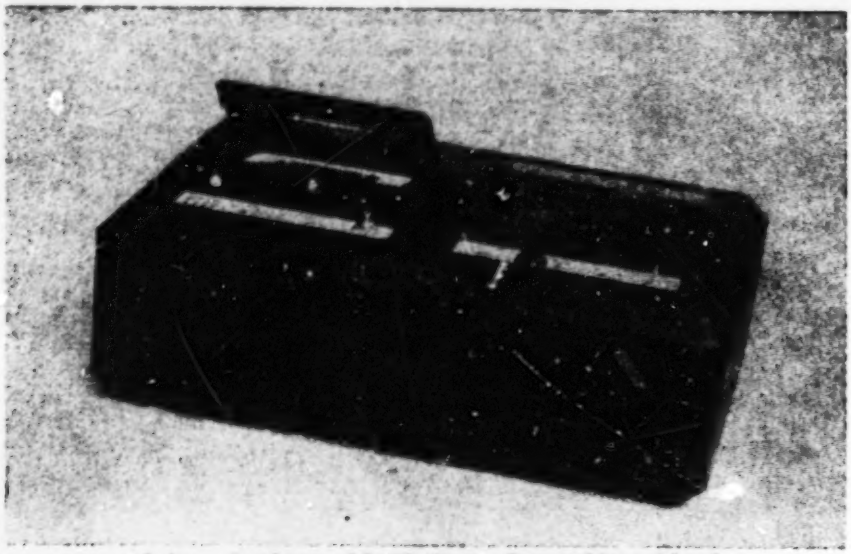


Spektur 15 Multichannel Spectrometric System
1.a. Spektur 15 K Optical-Electronic Block

These studies were continued later by the international crews involving the participation of cosmonauts from Hungary, Vietnam, Cuba, Mongolia and the USSR. I had the opportunity to work directly with all crews both before and after their flights. The importance of the studies and the great potential of Spektur 15 were frequently noted in the course of the preparations for the implementation of the scientific program in telemetric methods and work with the system. At the same time, we acquired the cassettes with recorded data returned by the crews, which were processed initially in Bulgaria at the TsLKI and subsequently by international scientific groups.

The decision of the Soviet governmental commission to adopt as regular (permanent) equipment the Spektur 15 multichannel spectrometric system for the subsequent

Salyut-type satellites was a high acknowledgment of Bulgarian science and technology. The recommendations of the several cosmonauts who had used Spektur 15 in space work were taken into consideration in the development of the next system. Let us mention above all V. Ryumin, V. Dzhanibakov, Yu. Romanenko, V. Lyakhov, B. Sarkas, N. Rukavishnikov and others. For example, it was cosmonaut V. Ryumin who suggested that light indicators be installed showing fitness for work, recording, overloading of the light flow and others within the range of the optical sight of Spektur 15 (which was introduced in Spektur 15 M) in the course of a meeting at the Yu. A. Gagarin Cosmonaut Training Center, immediately following his first 174-day space flight.



2.b. Spektur 15 KR Data Recording Block

The updated model of the Spektur 15 M multichannel spectrometric system, which will be installed on the next Salyut orbital station, was completed and accepted by the Soviet acceptance commission in July 1980.

An airplane variant of the Spektur 15 S multichannel spectrometric system was developed and tested under actual flight conditions in 1979-1980. It will be used in quasisynchronic studies and in the flight of the B-1300-II complex.

More than 50 tests were made with the Spektur 15 prior to the flight of the crews involving Mongolian and Romanian cosmonauts, synchronized with the Spektur 15 basic systems and apparatus, the MKF-6M and KATE-140. As K. Blagov, flight deputy manager, wrote in PRAVDA in April 1981, "...thousands of pictures were obtained with the KATE-140 Soviet printing instrument, thousands of multizonal pictures were made with the MKF-6M camera, developed by Soviet and GDR scientists, and several tens of thousands of spectrograms of natural formations were obtained with the Bulgarian Spektur 15 system...." The Spektur 15 system was extensively applied in resolving problems of agriculture. On 19 April 1981 TASS reported from Moscow that "more than 14,000 photographs and 100,000 spectral analyses of the earth's surface were made from the Salyut-6 orbital station for agricultural purposes (with the Spektur 15 system--author's note)...."

Spektur 15 was highly rated by the periodical NATURE, Vol 289, of 29 January 1981, and at the 1979 congress of the International Astronomy Federation, held in Munich, FRG, in the minutes of the working group on the telemetric study of earth from outer space.

In fact, as V. Kubasov, the famous Soviet cosmonaut, said at the 1980 congress of the international astronomy federation, held in Tokyo, "...the Spektur 15 system is not only unique but universal (for purposes of telemetric studies of earth from outer space--author's note)...."

The experience gained in the designing and use of the Spektur 15 system, which is a worthy representative of the great possibilities of Bulgarian science and technology, proved to be very useful in designing and building the scientific equipment for the B-1300-II project, particularly in the case of the SMP-32 multichannel spectrometric system, which enables us to record radiation in 32 channels of the visible and close infrared range.

In specific terms, the results obtained in the interpretation of data from measurements with the help of the Spektur 15 multichannel spectrometric system will be considered in a subsequent article in this periodical. However, we can note as of now that many new and interesting facts and results, which have found an application in science, technology and the national economy, have been obtained. The system is protected with several authorship invention certificates. New methods, technologies and systems have been developed as well. Perhaps the most accurate description of the system was provided by cosmonaut N. Rukavishnikov: "Spektur 15 is the latest all-seeing eye of the cosmonauts flying the Salyut-Soyuz complex." Here is what Bulgarian cosmonaut Col Engineer G. Ivanov said about the system:

[The following appears in the actual handwriting of G. Ivanov in the original text].

The Bulgarian Spektur 15 system was used in the course of 2 years of flights of the orbital Salyut-6-Soyuz-Progres scientific complex by members of six fraternal socialist countries! Could there be a greater recognition of Bulgarian scientific thinking and technology!

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REPORT ON NEW TECHNOLOGIES

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NO NAUKITE in Bulgarian No 3, 1981 pp 92-96

[Text] Method for Obtaining Steroid Hormones with a Pregnane Skeleton

The method is protected as an invention with registration No 45,363, 24 August 1979. It was developed at the Bulgarian Academy of Sciences Institute of Organic Chemistry with Phyto Chemical Center, by a group of authors headed by Senior Scientific Associate R. Vlakhov.

This invention resolves the problem of the production of steroid hormones, such as hydrocortisone, prednisolone, 6-methyl-prednisolone, and other compounds with a pregnane skeleton, which are valuable pharmaceutical preparations. The method is part of a Bulgarian progam, aimed at making extensive use of available raw materials for synthesizing steriod hormones. Currently, the main sources for the synthesizing of such pharmacological products are diosgenine, which is extracted from a cactus, and sterine, extracted from wasteproducts of the cellulose industry. The method is related to the production of Reichstein Substance from 17a hydroxyprogesterone, which could be obtained from either of these two raw materials.

This method makes it possible to obtain steroid hormones more effectively and profitably and with a lesser number of technological operations. On the basis of a raw material available in our country, based on the invention Reichstein Substance, free or with protected functional groups, from various basic compounds, through microbial hydroxylation, valuable pharmaceuticals in great demand may be produced such as hydrocortisone, prednisolone, and others, which are currently not produced by our pharmaceutical industry for lack of suitable technology and raw materials. Furthermore, our method allows for the production of substantial quantities in the individual stages of the synthesis of steroid hormones, as a result of which a number of reactions can take place within a single reactor without isolating the product from the subsequent stages. For the first time, this method makes it possible to protect on an industrial scale the carbonyle group in the third position of the steroic molecule in the form of a perchloroeamine salt.

This invention is being developed at the Chemical-Pharmaceutical Plant in St. Dimitrov and may be used as the basis for cooperation with pharmaceutical companies in industrially developed countries. A patent request has been filed by the Bulgarial Academy of Sciences in the USSR, the GDR, Poland, Hungary, Czechoslovokia, Romania, Yugoslavia, Greece, Cuba, Brazil, Argentina, Japan, India, Malaysia, Thailand and Singapore.

Method for Surface Modification of Synthetic Artificial and Natural Polymer and Polymer Compositions with Metals, Metalloids and Gases through Ion Implantation at Low Energy

The method is protected with three invention registrations (No 47,001, 13 March 1980, 47,765 of 14 May 1980 and 47,766 of 14 May 1980), with patent requests filed in the U.S., Great Britain, the FRG, Japan, Canada, France, Swedan, Switzerland, Italy, the USSR, Czechoslovokia, and the GDR with a view toward subsequent licensing. It was developed by the Bulgarian Academy of Sciences Institute of Nuclear Research and Nuclear Power Industry by K. Kolev, A. Dzhakov, R. Yankov, B. Amov and L. Peeva.

No data exist so far on the application of the method of Ion Implantation for the modification of surface properties of polymers (plastics, and artificial fabrics in particular). In this respect, our method, which is suggested for the first time, is a major step in the involvement of materials with qualitatively new characteristics. Polymer material modified through the implantation of metals, metalloids, and gases are characterized by the following most general properties:

The implanted element, part of which has permeated under the polymer surface, is firmly fastened to the polymer material and forms a stratum which does not crack or separate under mechanical influence (friction, bending, crumbling, twisting, washing, etc.);

Polymer materials modified on the surface through the implantation of metals and metalloids show a lowered surface electrical resistance, which can be reduced evenly within a broad range;

Such materials have a higher level of heat and light reflection;

They can be used as a substratum on which metals and metalloid lining can be applied with the help of any currently known process.

The main advantage of this method for metalizing plastics is that the preliminary treatment of the surface to be metalized becomes entirely unnecessary (the same applies to metalloids and gases), as is the need for the use of various lacquers and coatings as fixatives for the metal stratum. A small quantity (a few grams in metalizing dozens of square meters of area) of inexpensive salts, which must be industrially (and not also analytically) pure, are the starting product for the ionizing of the necessary metal (metalloid) in the ion source.

The practical application of this method is very promising. It could be successfully used in the chemical industry, medicine, agriculture, light industry, astronautics, consumer items, etc.

The method is currently under development at the Institute of Nuclear Research and Nuclear Power Industry, where a system for the manufacturing of prototypes has been created.

General Sowing Control System

The system is based on three inventions (Registration Nos 47,754, 47,755 and 47,756, dated 14 May 1980) at the Technical Cybernetics and Robotics Institute of the Bulgarian Academy of Sciences by a group of authors headed by Scientific Associate K. Boyadzhiev.

The system provides an objective basis for assessing the work of the plowshare of grain crop seeding machines, the rotation of the seeding shaft and the level of the grain in the hopper. It can control as many as eight sowing machines simultaneously using as many as 24 plowshares each. For this reason it is based on the modular principle: it consists of two main blocks and optical electronic meters. The control block is mounted on the tractor. The number of the improperly working machine and information on irregularly rotating shafts or inadmissibly low levels of seed in the hopper are indicated through sound signals and flashing lights. The control system is installed on each sowing machine. Digital light flashes indicate consecutively and cyclically the number of the irregularly functioning plowshare. The system provides extensive and easily accessible data without any additional handling on the part of the servicing personnel. It can be applied in checking grain crop seeding machines (joint sowing) of the SZ-3.6; CZU-3.6 and SZA-3.6 models, which are standard machines used in Bulgaria and the USSR, as well as machines with sowing plowshares of the same models.

The use of this totally automated system improves the regularity of the sowing, which yields greater economic results. Regular production of the system was undertaken at the Plant for Electronic Nonstandard Equipment in Tolbukhin in 1981.

Method for the Production of Glucosoisomerase

The method is protected by three invention registrations (Nos 45,720 and 45,721 of 29 November 1979 and No 49,423 of 21 October 1980), with patent applications filed in the United States, Japan, Canada, Mexico, the FRG, The Netherlands, Denmark, France, Italy, Great Britain, Belgium, Spain, Switzerland, Austria, Finland, the USSR, the GDR, Romania, Hungary and Yugoslavia, with a view to license sales and eventual protection of exported items. The inventions were developed at the Bulgarian Academy of Sciences Institute of Microbiology by a group of authors headed by Senior Scientific Associate Dr M. Stoychev and coauthors Scientific Associate Engineer G. Dzhezheva, I. Todorov and N. Stoeva.

Invention No 45,720 deals with a method for obtaining glucosoisomerase with strain streptomyces sp. No 765. This enzyme converts d-glucose into d-fructose, which is being increasingly used in the food industry and dietetic nutrition in a number of countries. The method has the following advantages: the strain produces the enzyme in the absence of cobalt ions in the fermentation environment and isomerizes the glucose into fructose also in the absence of cobalt ions, thus considerably simplifying the technological process and eliminating the use of ion-exchange systems for the separation of the cobalt from high-fructose syrups. The produced strain is superior to already-patented similar microorganisms and mutants because of its glucosoisomerase activity (from 7,000 to 12,000 GIE per liter of culture), favorable pH isomerization optimum (7.0), higher temperature optimum (80°C) and considerable thermal stability of the enzyme between 40°C and 70°C.

Invention registration No 45,721 applies to a method for obtaining glucosoisomerase from streptomyces sp. No 1339 strain. This enzyme converts d-glucose into d-fructose, whose syrups are being increasingly used in the food industry, public catering and dietetic nutrition in a number of developed countries. The advantages of the method are that the produced strain has the high biosynthetic possibilities of the enzyme (from 12,000 to 20,000 GIE per liter in a fermentation environment). The enzyme is characterized by its high temperature optimum (70°C) and requires low optimum concentrations of cobalt ions in the isomerization mixture. It has a favorable pH optimum (7.0) and a considerable thermal stability between 40°C and 65°C. The production of moist biomass ranges from 140 to 220 grams per liter in a fermentation environment.

Such enzymes can be produced by the Ministry of the Chemical Industry or the National Agroindustrial Union and can be used extensively by the food industry in the production of high-fructose syrups which are used by the sugar refining and canning industries, the production of nonalcoholic and alcoholic beverages, the confectionary industry, the baking industry, public catering, trade, dietetic foods, the feeding of bee colonies, and others.

Increasing Grape Production with Chlorocholinchloride (CCC) Treatment

A method and technology for the treatment of vineyards with a water solution of chlorocholinchloride (CCC) in the early spring, immediately before the blossoming of the buds, have been developed at the M. Popov Plant Physiology Institute of the Bulgarian Academy of Sciences, under the supervision of Prof Dr D. Lilov. This treatment temporarily reduces the intensity of the growth. As a result, higher amounts of nutritive substances reach the racemes, ensuring fuller fruit setting and an increased number of grapes and amends. The treatment can be highly effective only with well-cared-for and strong, rather than weak and sickly, vines. The making and spraying of the solution can be done manually or mechanically. The fruit twigs must be totally soaked, which requires about 60 liters per decare. Pesticides for use against diseases, pests and weeds may be added to the solution.

CCC has no adverse effect on the fruitfulness of the vines the following year. The 3-year industrial testing and model use of the technology have increased yields from 10 to 54 percent without worsening the quality of the grapes.

No such method for CCC treatment is known to exist currently in domestic and world science and practical experience. Savings from this method average 18 leva per decare. The Ministry of Public Health has allowed the use of this preparation in viticulture. Industrial tests and model application practices were conducted at the agroindustrial complex and the LVK (Viticulture and Wine-Making Combine) within the National Agroindustrial Union system.

Opening of a Central People's Park in Stara Planina

The Scientific Coordination Center for Environmental Protection and Reproduction (NKTsVOS) of the Bulgarian Academy of Sciences, headed by specialist Zh. A. Spiridonov, is working on the development of a large protected territory--a people's park--which will include the largest and most valuable reserves in Sredna Stara Planina: Tsarichina, Steneto, Stara Reka, Dzhendema, Peeshti Skali, Sokolna, etc. Typical mountain, high-mountain and rock habitats and ecological systems representing the

biotic variety of the Stara Planina area to the greatest extent, will be largely ensured over an area in excess of 40 hectares. Not only primary ecosystems of widespread and economically important forests (beech, for example), but coniferous, deciduous and mixed forests will be protected in the people's park and its reserves. Populations of hundreds of vegetal and animal species included in the "Red Book of Rare or Endangered Species in the Bulgarian People's Republic" will be protected in the park.

Runoff Control

Mathematical models, algorithms, block systems and computer programs have been developed and applied at the Bulgarian Academy of Sciences Institutes of Water Problems, under the direction Senior Scientific Associate N. K. Nikolova, for runoff control purposes. The Monto Carlo method was used for a basin of comprehensive use by n number of water users, regardless of the water utilization complexity. With such models and computer programs the runoff and irrigation water consumption are considered as interdependent probability processes. The programs yield the three possible curves of availability: siphoned-off water, the filling of the basin and the spilled quantities, on the basis of which optimum control parameters can be defined: the computed guaranteed water consumption, level of runoff control and basic capacity.

On the basis of the computed water shortages in the nonsecured season, the optimum support of irrigation, water supply and hydraulic power can be computed.

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FURTHER REPORT ON NEW TECHNOLOGIES

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 4, 1981 pp 77-80

[Text] Technology for Acid Brilliant Copper Lining and Complex Additions BS-1 and BS-2

The technology and the two supplements are based on four inventions (registration Nos 45,052 and 47,849 of 5 Oct 1979 and 45,879 and 45,880 of 10 Dec 1979), developed by Institute of Organic Chemistry and Institute of Physical Chemistry by a group of authors headed by Senior Scientific Associate I. Pozharliv and Senior Scientific Associate St. Rashkov. Together with the Institute of Chemistry and Chemical Technology of the Lithuanian SSR Academy of Sciences, a joint authorship certificate was registered in the USSR under No 2,973,802/02.

Patent applications for the main invention have been filed in the United States, Great Britain, the FRG, France, Italy, Brazil and Turkey.

The new additions and the technologies represent an advanced variant of the familiar additive for acid brilliant copper lining B-7211. They ensure a higher evening ability in the copper lining of complex-shaped parts eliminating dendrites and carbon deposits with high speed lining. They are superior to similiar technologies developed by foreign companies in terms of basic technical and economic indicators.

Such lining, based on our inventions, is used as the precoat in the chromium-nickel lining of steel items, zinc castings and metalizing of plastics. The automotive, household and sanitation industries are the main consumers for such additions. In cases where higher quality protective and decorative coating is required, the BS-1 and BS-2 technology and additions will be applied in the galvanizing shops of the enterprises of the Ministry of Machine Building and Electronics and elsewhere, as well as in automotive plants in the USSR and other socialist countries.

Industrial tests were conducted at the VAZ in Toliati, USSR. A sample industrial batch of additives was produced at the Chemical Plant in Kostenets. Exports of this item are expected to yield considerable foreign currency.

Khromopor Complex Additive and Technology for the Precipitation of Microporous Nickel-Chromium Lining

A technology has been developed for the precipitation of microporous nickel-chromium coating with a view to improving the corrosionproof qualities of the copper-nickel chromium multiple-layer system. The development is protected with three invention registrations (No 24,149/1975, No 24,886/11 Oct 1977 and No 48,779/7 Aug 1980), developed by a group of authors at the Bulgarian Academy of Sciences, Institute of Physical Chemistry and the D. Blagoev VINS [Higher Institute of the National Economy] in Varna, headed by Senior Scientific Associate St. Rashkov.

The microporous condition in the chromium coating is created by the precipitation of a nickel precoat with built-in nonconductor particles (the Khromopor Additive). The complex Khromopor Additive is superior to other such additives in terms of sedimentation durability. The increased corrosionproof ability of the multiple layer system makes it possible to reduce the thickness of the nickel stratum by about 30 percent.

The technology for the electrolytic precipitation of microporous nickel-chromium lining will be used in the lining of steel parts operating under demanding and very demanding operational conditions. Following the completion of successful semi-industrial tests at the Moskvich AZLK in the USSR, the plant undertook the industrial testing of the technology. The regular production of the Khromopor Complex Additive will be undertaken at the Chemicals Plant in G. Oryakhovitsa before the end of 1981.

Additive and Technology for Brilliant Nickel-Iron Alloy Lining

Invention No 39,401/13 Apr 1978, was made at the Institute of Physical Chemistry and patent applications were submitted in the United States, Great Britain, Japan, France, Italy, Yugoslavia, the USSR, the GDR, Czechoslovakia, Hungary, and Romania with a view to protecting this exportable commodity and creating conditions for the sale of licenses. The invention is the work of St. Vitkova, V. Mircheva, M. Kuncheva, G. Raychevski, St. Armyanov, Iv. Todorov, St. Rashkov, and M. Chomakova.

The main purpose of this development is to replace most of the brilliant galvanized nickel coats with brilliant nickel-iron lining (up to 30 percent iron) which is of equal functional quality. The advantage of this development is the considerable saving of nickel, which price on the international market is rising steadily and which our country imports. There are technical advantages in the use of this technology in galvanizing shops: The iron ions, which inevitably pollute the nickel lining electrolytes, do not have to be precipitated; the alloy offers a better base for the chromium lining in the sense that the lining ability of chromium electrolytes is better when deposited on nickel-iron compared to nickel; the nickel-iron lining has a higher degree of plasticity compared to nickel. The used electrolyte is almost half as dense as the nickel lining electrolytes, which requires a lower investment in the initial charging of the tubs, shorter electrolyte cleaning and treating time, and the easier and less reacting treatment of waste water.

The invention may be applied in protective-decorative lining in jewelry, electronics, furniture and household equipment, medical instruments, sports equipment, parts of bicycles, motorcycles and cars, etc. This development is in the process of application. The regular production of this brilliant additive has been organized and currently industrial tests are taking place in several galvanizing shops in the country.

Method for Obtaining Fine Protective-Decorative Nickel-Copper-Nickel Lining

The method is protected by invention registration No 46,543/8 Feb 1980. It was developed at the Bulgarian Academy of Sciences Institute of Physical Chemistry in coauthorship with specialists at Orgtekhnika in Silistra; Senior Scientific Associate St. Rashkov headed the group of authors.

A technology has been developed for the electrolytic coating of fine (5-12 microns) nickel-copper-nickel lining of steel parts. The procedure includes the preliminary preparation of the parts, the basic galvanizing processes with respective intermediate operations and the final process. This lining is shiny and smooth, perfectly clinging to the foundation and between the individual strata and has very good corrosionproof qualities. Modern highly productive electrolytes free from toxic chemicals are used for the production of the individual strata.

The technology was developed to meet the growing need for fine protective-decorative lining consistent with the strict requirements of computer equipment, electronics and electrical engineering. However, it can be used also for thick nickel-copper-nickel lining in machine building.

The technology is regularly used in industry and has been applied successfully at the Orgtakhnika Plant in Silistra as of Dec 1979 and at the Construction Elements Plant in Blagoevgrad since Jan 1980.

Structure and Technology for Colorless and Color Chromatizing (Passivation) of Shining Zinc Galvanized Lining

This development is protected with two invention registrations (No 44,462 and 44,463 of 26 July 1979). It was developed at the Institute of Physical Chemistry by the following authors: Scientific Associate V. Velinov, Scientific Associate D. Stoychev, Scientific Associate Iv. Krustev, Engineer I. Vitanova, Scientific Associate M. Nikolova, Senior Scientific Associate St. Rashkov, Chief Assistant G. Velinov and Chief Assistant L. Tsalev.

The technology may be used for colorless and color chromatizing. It is used for passivating shining Zinc lining with a view to upgrading resistance to corrosion. A major advantage of the passivation solutions is their very low content of chromium ions (from 0.16 to 0.22 g/l for colorless and 20 g/l for color passivation), which is substantially lower compared with other technologies. This saves chromium and facilitates the treatment of wastewater, therefore, it yields economic and social results. The passive conversion films provide very good resistance to corrosion,

good adhesion to the base, resistance to washing and bending, good external appearance, etc. The quality of the passivated lining is as good as the results of the best worldwide technologies.

The development is used at the Sukhe Bator APK (Agroindustrial Complex) in Srednogorie and the Maritsa Typewriter Manufacturing Plant in Plovdiv. It will be applied in a number of galvanizing shops for zinc lining and at enterprises of the Ministry of Machine Building and Electronics, Ministry of Light Industry, etc. These compositions are already under production at the Chemicals Plant in G. Oryakhovitsa under the trade marks of Duga for color passivation, and BP for colorless passivation and are being sold to consumer plants.

Electrolyte for Alkaline Noncyanide Zinc Plating "Ekolal-80"

This development includes the invention "Electrolyte for Alkaline Noncyanide Zinc Plating," registration No 48,520/17 July 1980, developed by the Bulgarian Academy of Sciences Unified Chemistry Center by the following authors: Scientific Associate V. Balutsov, Scientific Associate V. Velinov, Senior Scientific Associate I. Bozharliev, Senior Scientific Associate St. Rashkov, Professor I. Mladenov, Scientific Associate V. Mircheva, Scientific Associate M. Nikolova and Scientific Associate I. Krustev.

The technology for galvanic zinc plating was developed on the basis of a new type of alkaline noncyanide electrolyte, with a high dispersion ability, which makes possible the coating of corrosion-proof, evenly shining coating in a wide range of current densities. The main purpose of the technology is to replace the existing cyanic electrolytes for zinc plating, thus eliminating the threat to health from production servicing and the subsequent polluting of the environment with strongly toxic cyanic compounds. It also ensures the high quality of the lining and lowers production expenditures for the treatment of wastewaters.

The development is applied at the Maritsa Typewriters Plant in Plovdiv and the Radio Plant in Samokov. This electrolyte will be applied extensively at the galvanizing shops of the enterprises of the Ministry of Machine Building and Electronics and elsewhere for the preservation of steel parts from corrosion.

The regular production of unlimited quantities of this additive for electrolytes is being organized at the Chemicals Plant in G. Oryakhovitsa.

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COOPERATION IN JOINT INSTITUTE OF NUCLEAR RESEARCH DESCRIBED

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[Article by Frantisek Becvar, Pavel Exner, Miroslav Finger, Marian Gmitro, Richard Lednicky, Jaroslav Sedlak and Ivo Zvara, Dubna: "Twenty-Five Years of the Joint Institute of Nuclear Research"]

[Text] The writing of a new, significant chapter in the history of a number of branches of physics, mathematics, chemistry and engineering has been proceeding for the last quarter-century in Dubna, a modern, picturesque town on the banks of the Volga about 130 km north of Moscow. The Joint Institute of Nuclear Research [SUJV], an international scientific center for cooperation among the socialist countries in nuclear physics and associated fields, was founded here in 1956. Its principal mission is to find an answer to the simplest and at the same time most difficult questions to which man has fallen heir: the nature of matter, space and time. The institute's 25-year existence has convincingly shown what a fortunate undertaking this has been: for the institute has proven to be a particularly effective organization which is also having a pronounced influence on the overall quality of physical research, particularly in the smaller member countries.

The work of the SUJV has made an unquestioned contribution to the development of a number of areas of physics in Czechoslovakia, and all of the organizations involved have a high opinion of it. We take the opportunity of this year's significant anniversary to provide a survey of the purposes, organization and scientific work of the SUJV and of Czechoslovakia's participation in its research, prepared by members of our national group at Dubna.

We also take the opportunity to wish the SUJV new, important successes in its next 25 years and a continuation of the youthful, creative spirit which is so char cteristic of it.

The Joint Institute of Nuclear Research

This institute is the oldest and still the largest international research center of the socialist countries. Currently, scientists from Bulgaria, Hungary, Vietnam, East Germany, North Korea, Cuba, Mongolia, Poland, Romania, the Soviet Union and Czechoslovakia work in it. The institute is engaged in research on the physics of elementary particles, nuclear and neutron physics, the physics of condensed systems, nuclear chemistry and the development of accelerators. Including the

administrative departments, more than 6,000 persons are employed at the institute. Most of them are from the host country, while about 600 specialists have been sent to Dubna on long-term assignment by the other member countries; the majority are scientists and engineers.

The agreement to establish the SUJV was signed in Moscow on 26 March 1956 by plenipotentiary representatives of the member governments. The institute's charter, governing all of its activities, was adopted at the ensuing first session of the Assembly of Plenipotentiary Representatives on 23 September 1956.

The purpose and tasks of the SUJV can be briefly summarized as follows: joint experimental and theoretical research in nuclear physics (including all of the fields mentioned above), support for the development of nuclear physics in the member countries, support for contacts with national and international scientific research and other organizations in the field for the purpose of developing nuclear physics and identifying and making use of new possibilities for the peaceful use of atomic energy, and cooperation in comprehensive development of the creative capabilities of scientific research personnel from the member countries.

According to the agreement, the operation and development of the institute are funded by the member countries. The size of each member's contribution depends on its economic capabilities and national income. Currently, for example, the Soviet Union meets about 75 percent of the institute's budget, while Czechoslovakia's contribution is slightly more than 4 percent. According to the charter, however, the size of a member country's contribution does not affect its participation in the scientific work and management of the institute.

The highest management organ of the institute is the Assembly of Plenipotentiary Representatives of the member governments; the representative of the Czechoslovak Government is CSAV [Czechoslovak Academy of Sciences] Chairman Academician J. Kozesnik.* The committee meets annually and decides on such basic matters as the budget, the capital construction plan, long-term, five-year and annual scientific research plans, the size of the member countries' contributions, the acceptance of countries as new members and the like. The financial work of the institute is controlled by a committee in which each member country has one vote.

The management of the institute is chosen by the Assembly of Plenipotentiary Representatives and is responsible to the latter for all of the institute's activities: scientific, financial and administrative.

A scientific council, which meets twice a year, makes decisions on the institute's scientific activity. According to the charter, each member country is represented on the council by three leading specialists. The council discusses and approves plans for scientific research and international contacts, research reports, and awards prizes for the best work. The scientific council submits its proposals regarding scientific planning, financing, the construction of new facilities and the like to the Assembly of Plenipotentiary Representatives.

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* (Ed. note: The draft of this article was written in 1980).

Within the institute, there are a number of consultative and cooperative bodies created by special agreements; these include the scientific councils for high-energy, low-energy and theoretical physics, which are sections of the institute's scientific council. Special committees operate within these sections, and scientific and technical councils and scientific certification councils function in the institute's laboratories.

The organizational structure of the institute follows from the general principles laid down in the charter. The institute has six laboratories. The four experimental laboratories, namely, the Laboratory of High Energies, the Laboratory of Nuclear Problems, the Laboratory of Nuclear Reactions and the Laboratory of Neutron Physics, which by their size are in fact large research institutes, work with unique basic equipment: proton accelerators, synchrophasotrons and synchrocyclotrons, cyclotrons for accelerating heavy ions, pulsed nuclear reactors and the like. Two other laboratories, the Laboratory of Theoretical Physics and the Laboratory of Data Processing and Automation, have an important role; none of the other laboratories could operate without their services. The institute also has a department of new acceleration methods, which is in fact a seventh laboratory. Each laboratory is divided into departments, which are in turn divided into sectors; each sector is generally assigned one research task. The management of the SUJV decides on the basic financial questions involved in the laboratories' work; directly subordinate to it are the administrative and production sections and several specialized departments such as the department of international contacts, the scientific secretariat, the publications and patents department and the like.

The highest management posts in the SUJV, namely, the positions of director and (two) deputy directors of the institute and directors and deputy directors of the laboratories are filled by election from among the representatives of the member countries. Traditionally a Soviet physicist is chosen director of the institute. Between the founding of the institute and 1964, a Corresponding Member of the USSR Academy of Sciences, D. I. Blokhintsev, recently deceased, held this post. Since then the director has been Academician N. N. Bogolyubov, who is world-renowned for his work in theoretical physics. Representatives of almost all of the member countries have alternated in 3-year terms as deputy directors; physicists from our country have been deputies three times.

Czechoslovakia's Participation in the SUJV

Our republic is one of the founding members of the SUJV and since its founding has also been one of the countries most actively participating in the scientific research program. This is also reflected in the institute's leadership posts. Representatives of our country have been chosen deputy directors of the institute three times: Academician V. Votruba in 1956-1969, Prof I. Ulehla in 1964-1967, and Prof C. Simane in 1973-1976. Many of our personnel have also held leading positions in the various laboratories. Currently, for example, Czechoslovak physicists are acting as deputy directors of the Laboratory of Nuclear Problems and the Laboratory of Neutron Physics.

The Czechoslovak national group is traditionally one of the largest in Dubna; currently only the groups from East Germany and Poland are somewhat larger. Czechoslovakia is now represented in the institute by about 65 persons sent there

on long-term assignment, generally for several years, by their parent organizations in a number of ministries (CSAV, MS [Ministry of Education], CSKAE [Chechoslovak Atomic Energy Commission] and the like). They include 1 doctor and 30 candidates of science. In addition, every year about 200 of our specialists visit Dubna for brief periods of from several weeks to several months. These visits generally involve the solution of specific problems. Also working in the institute are a number of spouses of Czechoslovak representatives; the institute employs a total of about 90 of our citizens. Staff members on long-term assignment are generally accompanied by their families. On the average, about 150-180 Czechs and Slovaks live here.

Each of the laboratories has its own indispensable role in the structure of the institute, and naturally our participation varies from laboratory to laboratory. Traditionally we are most strongly represented in the Laboratory of Nuclear Problems and the Laboratory of Theoretical Physics (a simple comparison of numbers of personnel cannot be made; the number of theoreticians among those engaged in physical research must be taken into account). At the end of this quarter-century we may express justifiable pride in our staff members' participation in the contribution which these two laboratories have made to worldwide science. In addition, Czechoslovakia is strongly represented in the Laboratory of High Energies and the Laboratory of Neutron Physics, and the results achieved by our personnel have earned no less recognition there. Staff members from our country have also taken part in important successes of other laboratories in the institute, even though our country is much less strongly represented in them. A more detailed survey of our specialists' work in the SUJV is given in the sections dealing with the individual laboratories below. An important form of cooperation between Czechoslovak institutes and the SUJV is the processing in Czechoslovak organizations of experimental data obtained at the institute, often as part of international cooperation.

A concrete expression of the value placed on the scientific results achieved by the members of the institute is the prizes which are awarded annually for the best work in theoretical, experimental and applied physics, as well as high-level, state and other prizes. At the end of this survey we list the SUJV prizes which have been awarded to collectives in which Czechoslovakia has participated. Another criterion is the number of scientific degrees awarded. During the institute's existence, dozens of Czechoslovak specialists have defended candidate's dissertations here, and two have defended doctoral dissertations.

The Laboratory of High Energies

This laborotory is the largest in the institute and is one of two which were presented to the institute by the Soviet government when the SUJV was founded in 1956. Currently more than 1,000 persons work in the laboratory, including 16 doctors and about 80 candidates of sciences. The laboratory director is A. M. Baldin, Corresponding Member of the USSR Academy of Sciences.

The main experimental installation of the laboratory is a synchrophasotron which accelerates protons to 10 GeV with an intensity of 10^{12} protons per pulse (about one every 9 seconds), which became operational in 1959. Since 1979 it has also been used to accelerate light nuclei, enabling the laboratory's physicists to begin research in the previously unexplored field of relativistic nuclear physics.

The laboratory develops and systematically improves new experimental equipment, in addition to which it makes extensive use of promising methods of particle detection and the latest achievements of radioelectronics and data processing. International cooperation is particularly important in this laboratory. The equipment developed here is being used not only with the institute's accelerator beams, but also in the accelerators of the Institute of High-Energy Physics in Serpukhov, in CERN [European Organization for Nuclear Research] in Geneva, and in the Fermi National Accelerator Laboratory (FNAL) in Batavia, United States. These include the NA-4, BIS, ALFA, DISK and FOTON spectrometers, consisting of drift, spark and proportional chambers, as well as Cerenkov counters with on-line computers, large streamer and bubble chambers such as the SKM-200 and LUDMILA, and other unique devices.

The Laboratory of High Energies has also developed and produced modern electronic equipment for physical experiments, such as a wide selection of assemblies and recording electronics using integrated modules of the CAMAC system. Cryogenic techniques are also being successfully developed. Several hydrogen bubble chambers and a large number of targets filled with liquid hydrogen and deuterium have been produced. To investigate elastic scattering of protons by protons, deuterons and nuclei using the proton beam from the accelerator, an original-design target in the form of a stream of gas was developed; after the conclusion of experiments at Dubna these were also put into use in Serpukhov and Batavia. An important place in the laboratory's development is occupied by work on the NUKLOTRON project, an accelerator complex for relativistic nuclei which uses superconducting magnets.

The main areas of physics research in the Laboratory of High Energies include investigation of the structures of elementary particles and their interactions, resonance states and the dynamics of multiple-particle production, and the study of weak interactions and the interactions of nuclei at relativistic energies. Among the results in which physicists at the laboratory lead the world we may mention the discovery of the anti-sigma-minus hyperon, measurement of the electromagnetic radius of negatively charged pions, and the discovery of channeling of protons in a flexed crystal.

At present, Czechoslovakia is represented in the Laboratory of High Energies by 12 workers sent to Dubna on long-term assignments by 7 Czechoslovak organizations, working in various departments of the laboratory, as described below.

1. In the experimental hydrogen chamber department, studying the interaction of antiprotons and antideuterons with protons and deuterons using the 2-meter LUDMILA hydrogen chamber located in a channel of separated particles from the Serpukhov accelerator. This work is being carried on with extensive international cooperation involving about forty physicists from 11 institutes in Bulgaria, Czechoslovakia, Finland, Romania and the Soviet Union. Our organizations include the Institute of Physics, CSAV, the Nuclear Center of MFF UK [Department of Mathematics and Physics, Charles University], and the Department of Nuclear Physics of UPJS [Pavel Jozef Safarik University]. Czechoslovak physicists have an exceptional position in these experiments owing to their contribution to the design of the LUDMILA chamber and their development of the initial proposal for the program of physics experiments using the chamber.

2. In the experimental chamber department, studying interactions of protons with the nuclei of a photographic emulsion. Some 35 physicists from 11 institutes in Czechoslovakia, Mongolia, Romania and the Soviet Union are working on this task, including representatives of UPJS in Kosice and the Institute of Nuclear Physics in Rez. In addition, work is being done to develop new types of trace detectors from silver halide monocrystals.

3. In the experimental electronics department, studying highly inelastic interactions of muons with nuclei. This experiment, designated NA-4, is intended to study the structure of nucleons at very short range and to test the theory of weak and electromagnetic interactions. The equipment is installed on the proton supersynchrotron at CERN. A number of personnel from the SUJV member countries and CERN member countries are working on this task, including personnel from the Institute of Physics, CSAV and the Nuclear Center, MFF UK, as well as physicists from Sacalay, Munich and Bologna, totaling about 150 persons.

4. In the new scientific projects department, designing a measuring system for monitoring superconducting magnets. The Institute of Physics, Slovak Academy of Sciences is working on this task.

5. In the cryogenics department, working on the superconducting accelerator NUKLOTRON and UNK projects. Personnel from the Institute of Electrical Engineering, Slovak Academy of Sciences, have developed diagnostic methods for testing the pulsed superconducting magnets. In addition, the Skoda National Enterprise in Plzen and the FEROX National Enterprise in Decin are working on a short-term problem, the development and production of superconducting quadrupoles to guide beams of accelerated particles in the laboratory's synchrophasotron.

Czechoslovak personnel on short-term assignments to Duba are cooperating on a number of other topics being dealt with by the laboratory. These include the search for new resonances using the DISK-2 spectrometer (FZU [expansion unknown], CSAV, the study of the interactions of alpha particles with protons in a 1-meter hydrogen chamber (UPJS Kosice), experiments with a 2-meter propane chamber (Department of Nuclear Physics, MFF UK) and the like.

The Laboratory of Nuclear Problems

This is the oldest laboratory in Dubna and one of two which were formed on the basis of the Joint Institute in 1956. Currently it has more than 800 personnel, including 19 doctors and about 100 candidates of science. The director of the laboratory is V. P. Dzhelepov, Corresponding Member of the USSR Academy of Sciences.

The main experimental installation in the laboratory is the synchrocyclotron, which is currently being reconstructed. After the reconstruction is completed in 1981 it will provide a beam of protons with an energy of 700 MeV and an intensity of about 50 microamperes, i.e., about 21 times higher than previously.

The range of scientific problems studied by the Laboratory of Nuclear Problems is quite extensive and includes the solution of fundamental problems of nuclear physics and the physics of elementary particles, and also the solution of specific problems of physics of the condensed state, meson chemistry, dosimetry, and

radiation protection. In addition it studies the effect of various types of radiation on biological specimens, and an important part of the laboratory's program is occupied by accelerator physics and engineering and low-temperature engineering.

The reconstructed synchrocyclotron will make it possible to carry on research in the laboratory's traditional areas of physics at a new experimental level. These areas include, in particular, nuclear spectroscopy, which in recent years has focused on the systematic study of neutron-deficient isotopes of the rare earths as part of the JASNAPP [expansion unknown] program. The laboratory's contribution is its work on the SPIN [expansion unknown] equipment, which is the task of Czechoslovak physicists and engineers. The aim of research work with this device is investigation of the decay of short-lived nuclei, using hyperfine interactions at very low temperatures, and the application of this technique to research in nuclear physics and the physics of condensed matter. The work involves extensive international cooperation in which about 50 physicists and engineers from many countries are involved. Czechoslovak organizations involved in the work include Charles University, CVUT [Czech Institute of Technology], FZU, CSAV in Prague, and UPT [Institute of Instrumental Engineering] in Brno.

For almost 20 years, the Laboratory of Nuclear Problems has been studying catalysis of the fusion of hydrogen isotope nuclei by muons. The resonance nature of fusion of deuterium and tritium nuclei was proposed theoretically and demonstrated experimentally. Calculations have shown that during its lifetime the muoni is capable of catalyzing more than 100 fusions of deuterium and tritium nuclei into helium, causing the liberation of about 2 GeV of energy. Experiments have confirmed the correctness of the theory. The study of these phenomena will constitute one of the most important areas of research with the reconstructed accelerator.

In the physics of elementary particles, the properties of strong interactions of nucleons and pions, electromagnetic processes, and weak interactions in processes involving pions and muons have been studied. Detailed study of nucleon-scattering led to the determination of their effective reaction cross sections at low energies. Investigation of the interactions between pions and nucleons produced data confirming with high precision the charge-independence of the nuclear forces and demonstrated the correctness of the principle of causality within experimentally attainable limits. In addition, polarization phenomena in elastic scattering of neutrons by protons have been studied using a polarized target at a neutron energy of 600 MeV. The new reconstructed accelerator will allow the study of low-probability phenomena such as rare pion and muon decays. In addition, an experimental facility for the study of the effect of protons and negatively charged pions on the cells of malignant tumors is being built.

In recent years, the laboratory has been stepping up its research in particle interactions at high energies using the accelerator of the Institute of High-Energy Physics at Protvino near Serpukhov. Primary interest is directed toward the quark-parton structure of hadrons and multiple production of secondary particles. In addition, experiments involving the study of polarization phenomena in the collisions of strongly interacting particles and studies of the production of neutral mesons and photons by relativistic beams of positronium are also being prepared. For this purpose, the laboratory is developing a detector system

consisting of dozens of detectors of various types. The most important components of these are electronic devices (proportional and drift chambers, spark chambers, Cerenkov radiation detectors and the like), which can be connected directly to computers.

The laboratory has been designated the responsible organization for SUJV's scientific program at the Institute of High-Energy Physic's accelerator in Protvino, where 10 large detection devices prepared for experiments scheduled for 1981-1985 have been installed. The largest of these is the HYPERON spectrometric system, in whose construction personnel from UFF [? Physics Institute] SAV, PF [? Physics Faculty] UPJS in Kosice and PF UKo [? Physics Faculty, Komensky University] in Bratislava participated. The equipment will be used to study the interaction of positively charged particles with exchange of hypercharge and the production of two or more strange particles in the final state.

Another device built with Czechoslovak participation (FZU CSAV Prague) is a relativistic ionization spectrometer and streamer chamber (RISK) intended for the study of the quark-parton structures of elementary particles and the interactions of nucleons, mesons and protons with nucleons and heavy nuclei. Two of the experiments to be carried out with this equipment next year were designed in cooperation with FZU CSAV and PF UKo. Staff members of FZU are finishing the preparation of the apparatus for another experiment whose aim is to study the occurrence of the J/psi resonance accompanied by the production of other strongly interacting particles. This is expected to result in new data on the structure of hadrons and the mechanism of their interaction.

Thus the Laboratory of Nuclear Problems is the laboratory in which Czechoslovakia is most strongly represented: currently about 30 Czechoslovak personnel on long-term assignment work in it. In addition to the institutes and faculties mentioned above, these include physicists from the Department of Mathematics and Physics of Charles University in Prague and from several departments of CVUT (experiments of the SPIN device), and specialists from a number of other Czechoslovak organizations.

The Laboratory of Nuclear Reactions

This laboratory was founded in 1956 not long after the creation of the Joint Institute. Now it has more than 350 workers, including 7 doctors and about 50 candidates of science. The laboratory director is G. N. Flerov, Academician of the USSR Academy of Sciences.

The experimental base of the laboratory consists of three cyclotrons. The oldest of these is the U-300 classicial cyclotron with 3-meter magnet field pieces. The U-200 cyclotron, 2 meters in diameter, with azimuthal variation of the magnetic field, was built later; it is currently being used as the model for the newest device, the 4 meter U-400 cyclotron. All this equipment is designed for accelerating heavy ions (boron, carbon, oxygen and the like, through xenon in the case of the U-400), to which they impart an energy equivalent to about one-tenth the speed of light. This is sufficient to produce nuclear reactions with any target nuclei.

The U-300 cyclotron, which went into operation in 1960, was for many years the foremost in the world in terms of its characteristics (variety of particles and

beam intensity). The construction of the U-400 cyclotron was a logical and inevitable step toward providing a modern experimental basis for future research on heavy ions by the SUJV member countries.

The main research task of the laboratory is study of the properties of new elements in the periodic table. Their synthesis results from fusion of accelerated nuclei with target nuclei of uranium and transuranium elements provided in a reactor (plutonium, curium, californium and the like). In the past, elements with atomic numbers from 102 to 107 have been discovered at Dubna, and the radioactive properties of a number of their isotopes have been determined. The basic chemical properties of elements 102, 103, 104 (kurchatovium) and 105 (nielsbohrium) were first studied here. Other notable successes of the laboratory which have received worldwide recognition include the discovery of new types of radioactivity, i.e., delayed emission of protons and delayed fission, fundamentally new types of nuclear isometry consisting of differences of shape, and a new type of nuclear reaction, i.e., highly inelastic processes in the collision of complex nuclei.

The search for new elements continues, with attention focusing on those with atomic numbers above 107. Current theoretical conceptions of nuclear structure suggest that there should be relatively stable elements, i.e., elements with long radioactive decay half-life, in this range. The experimental proof of the existence of such superheavy elements would be of great importance for nuclear physics and chemistry as a confirmation or refutation of a number of theoretical ideas. It is of course not impossible that these components exist in trace quantities in nature as well, and so, in addition to attempts at synthesis, considerable attention is being devoted to the analysis of natural materials.

The Laboratory of Nuclear Reactions is currently working on the technical development of accelerators. It suffices to note that the U-400 cyclotron, whose magnet weighs about 2,000 tons, was manufactured almost completely in the SUJV, with laboratory staff members taking the main role in computations, design, construction and installation; this also made it possible to make running changes and improvements in design details. The whole unique device was built in 3 years and put into operation at the end of 1978. It should also be noted that the sympathetic attitude of Czechoslovak plants, which delivered certain necessary machines on short schedules, contributed to the success of the undertaking.

The Laboratory of Nuclear Reactions is devoting considerable attention to the use of the methods of nuclear physics and chemistry in engineering. It is engaged in simulating damage to materials in breeder reactors, studying the effect of heavy-ion irradiation on the mechanical properties of metals and the like. Particular attention is being devoted to the production of so-called "nuclear filters" by chemical etching of plastic films irradiated with a beam of heavy ions. This produces membranes with openings ranging from several hundredths of a micron up, with all channels having exactly the same size, making this product superior to all previously-known types of filter membranes. Nuclear filters have extensive potential for use, and their production by the procedure described is extremely inexpensive.

The laboratory has also built a compact electron accelerator (microtron) and has developed a number of procedures for activation analysis of various materials

using gamma radiation and neutron beams produced by conversion of a primary electron beam. Two new, more powerful devices of this type are being built in cooperation with CVUT in Prague. One will be installed in Prague and the other in Dubna; they are expected to become operational in a few months. The microtron offers considerable potential for express analysis of the ores of rare metals and for determining the nitrogen content of biolocal specimens and the like.

Czechoslovak specialists are taking a particularly important part in the chemical research being conducted in the laboratory. Currently, our republic is represented in the laboratory by one member of UJV [Institute of Nuclear Research] CSKAE on long-term assignments as section chief.

The Laboratory of Neutron Physics

This laboratory was founded in 1956. It currently employs more than 500 persons, including 3 doctors and about 45 candidates of science. The laboratory director is an Academician of the USSR Academy of Sciences, I. M. Frank, a Nobel Prize winner.

The main equipment of the laboratory is the IBR-30 and IBR-2 pulsed fast-neutron reactors, which by their conception and characteristics are unique neutron sources. Thanks to a method based on the analysis of neutron time-of-flight, both reactors can be used as multipurpose neutron spectrometers with high resolution and brightness. This is also their main advantage compared with powerful steady-state reactors intended for physics research. The promise of pulsed reactors has been shown by a body of physical data obtained during the 20 years of operation of the IBR-30. The qualitatively new plutonium-fueled, liquid-hydrogen-cooled IBR-2 reactor is currently in the power production startup stage. Its average power will be 4 MW, i.e., about 100 times that of the IBR-30, while the pulse power will reach 8 GW. It is expected that a number of demanding experiments requiring a high slow-neutron flux will become possible with the new reactor.

An additional promising device, the LIU-30 linear inductive electronic accelerator, is under construction. The current of the electron beam in this accelerator will reach 250 A in 1-microsecond pulses, with electron energies of 30 MeV. It is expected that this device will operate in connection with the IBR-2 reactor. The electron beam will be used for pulsed generation of neutrons, which will then be multiplied in the reactor core. A combination of this type has turned out extremely well in the case of the IBR-30 reactor and the LUE-40 electron accelerator.

The scientific activity of the Laboratory of Neutron Physics is concentrated in the following areas: investigation of atomic nuclei by neutron spectroscopy, investigation of the fundamental properties of the neutron, use of neutrons to investigate the atomic structure of condensed matter and, of course, applied research.

Its research in nuclear physics primarily involves the detailed study of neutron resonances occurring during the interaction of slow neutrons with nuclei. For a number of years, the laboratory has been systematically measuring resonance parameters, making various polarization measurements, studying the isomeric shifts of resonances, measuring their magnetic dipole moments and the like. Important information on the structure of the nucleus has been obtained by the study of

various neutron resonance decay paths. The laboratory has obtained particularly many original experimental results in the study of alpha decay of isolated resonances. In addition, the laboratory has studied the fission of heavy nuclei by slow neutrons for many years in order to gain a detailed understanding of the mechanism of this reaction.

The experiments on interactions between neutrons and electrons involve the fundamental properties of the neutron. In the next few years, an experiment aimed at finding the electric dipole moment of the neutron will be performed. The TRISTOM equipment to be used for this purpose is currently being installed on the beam of the IBR-2 reactor. The promise of this and similar experiments involves primarily the physics of ultracold neutrons. The Laboratory of Neutron Physics has played a decisive role in this area. Ten years ago it succeeded in demonstrating the existence of ultracold neutrons and the possibility of extracting them from the reactor moderator. Fundamental research in neutron optics will become possible with the DIFRAN device which the laboratory is preparing at the initiative of Czechoslovak specialists.

In the physics of condensed matter, the laboratory is investigating the structure and dynamics of solids and liquids through elastic and inelastic scattering of slow neutrons. New diffraction methods involving analysis of the flight time of neutrons have been worked out. Considerable successes have also been achieved in the study of quantum effects in liquid helium and investigation of the properties of molecular crystals. Small-angle neutron scattering has been used to determine the structures of various biological specimens. Recently, biomedical research using slow and fast neutrons has been expanding.

Currently, nine Czechoslovak workers on long-term assignment from the Institute of Nuclear Physics, CSAV in Rez, FJFI [Department of Nuclear and Physical Engineering], CVUT in Prague, the Institute of Physics of SAV in Bratislava, Komensky University and other organizations have been working at the laboratory. Cooperation is arranged so that the results obtained at the laboratory and at domestic organizations complement each other. Czechoslovak personnel in the laboratory are working on the following tasks:

1. radiative capture of resonance neutrons;
2. fission of heavy nuclei by resonance neutrons;
3. neutron optics and its applications;
4. use of neutrons for research in the physics of condensed matter and molecular biology.

The Laboratory of Data Processing and Automation

This laboratory is relatively young, having been founded in 1966. Currently it has 570 workers, including 4 doctors and 32 candidates of science. The laboratory director is M. G. Meshcheryakov, Corresponding Member of the USSR Academy of Sciences.

The need for creation of the laboratory stemmed from the rapid increase in the quantity of experimental data and the need to process the data effectively. Equipping the individual laboratories with their own computer equipment proved ineffective. The new laboratory had the mission of seeing to most of the

institute's data processing equipment, including technical maintenance and provision of software support. It was also assigned the task of developing means of automating physics experiments and processing data, as well as the mathematical solution (primarily by numerical methods) of physical problems.

Currently the computer complex of the Joint Institute consists of more than 50 stand-alone computers of various sizes. Most important among them are the large BESM-6 Soviet-produced computer and a CDC-6500 (produced in the United States), whose total capacity is about 2 million operations per second. The medium-sized and small computers, primarily from the CEMA Unified System of Electronic Computers [JSEP], are located in the laboratories' measurement centers, where they are used for direct control of individual experiments and for preprocessing of experimental data. Most of them are connected to the BESM-6 computer.

In recent years it has been possible to considerably expand the internal memory of the BESM-6 computer by means of JSEP-5061 magnetic disk units, so that it now has a capacity of 290 Mbyte. A multiplexor and telegraph channel adapter has been developed and debugged for the JSEP-1010 computer, making it possible to connect a total of 16 terminals to the BESM-6. The CDC-6500 computer is used exclusively to solve large-scale problems and process large data sets. Both main computers are in operation about 7,000 hours a year. The laboratory is carrying on systematic research work aimed at modernizing the computers and improving the effectiveness of their operation and is developing methods of visual display of data and interactive interfacing ewith the computer. In addition, the software of the various types of computers is being improved.

Initially, the laboratory concentrated its attention on automating photography in the track detectors (bubble or spark chambers and the like). Equipment for examining the photographs and devices for processing them semiautomatically or automatically were designed and produced. Currently, 20 scanning devices and 15 semiautomatic and 4 automatic devices for making measurements on track-detector photographs are available. The system includes the SAMET semiautomatic scanning and measuring apparatus produced by FZU CSAV in Prague.

Experiments in nuclear and high-energy physics have come to use more and more electronic detecting equipment in on-line connection with the computer. As a result the role of microprocessors in automating physics experiments has considerably increased.

A television system for monitoring the operation of the 5-meter streamer chamber and equipment for digital recording of track coordinates in the chamber and their entry into the memory of a JSEP-1040 computer were developed for the RISK project.

The Laboratory of Data Processing and Automation is developing new mathematical methods for solving specific problems of theoretical and experimental physics and is improving existing computation algorithms. Much of this work is important not only for immediate use but for mathematical theory in general. For example, methods of solving nonlinear equations and numerical solutions of problems in mathematical physics and plasma physics are being studied, and the mathematical simulation of physical processes is being improved. In addition, systematic attention is being devoted to accelerator and nuclear reactor design computations and the like.

A subsidiary but by no means unimportant area of the laboratory's activity is automation of many types of activities associated with management of the institute: wage and materials accounting, inventory management and the like. Currently two Czechoslovak workers are on long-term assignment to the laboratory, in addition to which some of our physicists operating in other laboratories at the institute maintain close contact with the laboratory.

The Laboratory of Theoretical Physics

This laboratory was founded in 1956. From its initial small collective grew one of the largest theoretical physics organizations in the world. Currently, the laboratory has about 160 scientific personnel, including 27 doctors and about 77 candidates of science. The laboratory manager is N. N. Bogolyubov, Academician of the USSR Academy of Sciences.

The laboratory's research program can be divided into three main areas: theory of elementary particles, theory of the atomic nucleus and theory of condensed matter.

In the physics of elementary particles, the efforts of the laboratory personnel have traditionally been concentrated on quantum-field theory with reference both to its internal structure and to its implications for the phenomenology of elementary particles. In the first years of the laboratory's existence, important results were obtained in the area of dispersion relations. During a long period these governed further development of theory worldwide, particularly in the field of strong interactions. Personnel of the Laboratory of Theoretical Physics also made a major contribution to the development of the mathematical bases of quantum-field theory. Among specific contributions we may cite the method of renormalization groups and the development of nonlocal, nonlinear and nonrenormalizable field theories. A new approach to problems of scattering theory, the so-called quasipotential method, was worked out in detail. Pioneering results in the symmetry of elementary particles and in dynamic quark models were obtained. A school studying the geometric properties of space-time at extremely short ranges grew up and is functioning successfully at Dubna. Recently, intensive work has been conducted in calibration theories and in quantum chromodynamics, a promising theory of strong interactions, as well as in the unified theory of electromagnetic and weak interactions. Attempts at a "grand synthesis," i.e., the creation of a theory which would allow the description of small and electromagnetic-weak interactions in the same fashion, are attracting attention, as is work in the quantum theory of gravitation, new, more profound study of the mathematical bases of field theory and other problems in whose solution the laboratory personnel are taking an important part.

Investigations in nuclear physics involve the structure of the atomic nucleus and the mechanisms of nuclear reactions. Theoretical methods of quantum physics and the theory of superconductivity have served as the basis for a microscopic model of the atomic nucleus which, by means of the so-called "Bogolyubov transformation," takes account of the tendency of a neutron-proton pair to create paired aggregates with zero angular momentum. This theory has made it possible to understand the essence of quasiparticle and collective states of the atomic nuclei and their dynamic and static properties. The laboratory has also obtained theoretical results of importance for understanding the mechanisms by which individual

nucleons and complex objects (e.g., heavy ions) interact with nuclei. Recently, major efforts have been devoted to developing a theory of the scattering and capture of light particles (electrons or muons) and mesons (pions and kaons) in interactions with nuclei. This work has shown a universal mechanism of nuclear response, i.e., the occurrence of collective nuclear states or "giant resonances," exists for an extensive class of reactions.

Almost 15 years of work in the three-body problem has enabled the theoreticians of Dubna to forecast a catalytic reaction, the acceleration by an order of magnitude of the fusion of deuterium and tritium nuclei in a medium containing muons. The basic physical mechanism of this "muon catalysis" was experimentally confirmed in 1979 by the Laboratory of Nuclear Problems and could lead to a fundamentally new method of commercial energy production.

The group of workers in the laboratory dealing with the theory of condensed matter is small. Organizationally it is attached to the department of phsics of the atomic nucleus. This group is studying phase transitions, problems of magnetism, the physics of crystal lattices and the like.

As a theoretical organization, the laboratory has a rather extraordinary position in the institute. It might appear that this would eliminate the factors which make cooperation so favorable for the small member countries in other laboratories, particularly the opportunity to use expensive, unique experimental equipment. But many years of experience confirms that constant work contact with the international collective of the laboratory is considerably increasing the effectiveness of research in Czechoslovak organizations. The two-sided interest in maintaining and deepening technical contacts is also manifested in agreements. For example, an agreement between the Laboratory of Theoretical Physics and UJF [Institute of Nuclear Physics] CSAV for joint research on meson-nuclear processes and an agreement between the laboratory and the Nuclear Center of MFF UK for joint research on algebraic and functional-analysis methods in quantum-field theory have been signed.

Currently, eight Czechoslovak workers on long-term assignment from UJF CSAV, the Department of Mathematics and Physics of Charles University, and FU [Institute of Physics] CSAV are working in the laboratory. They represent Czechoslovakia in accomplishing the main tasks of the laboratory. The success of this cooperation is attested, for example, by the considerable Czechoslovak participation in which collectives have been awarded prizes for the best scientific work in the SUJV. The tradition begun by Academician Vaclav Votruba, the Nestor of Czechoslovak theoretical physics, is thus being successfully continued.

The Department of New Acceleration Methods

This department was founded in 1968. Currently it has about 400 personnel, including 2 doctors and 12 candidates of science. The director of the department is V. P. Sarantsev, Doctor of Physical and Mathematical Sciences.

The basic task of this department is the development of fundamentally new methods of accelerating charged particles. In the "collective" accelerator, heavy particles (protons and ions) are captured by an electron ring and are accelerated along with the electrons, so that the heavy particles acquire about 50 times more energy than if they were accelerated by themselves in a field of the same intensity.

During the first stage of the work, the department designed models of a heavy-ion collective ionizer. For this purpose it constructed a powerful electron accelerator, several types of "adhesators" (devices creating the ring) and other equipment. In 1969 the first electron ring was obtained with the adhesator. In 1976 a prototype collective accelerator was put into operation; this imparted an energy of 4 MeV per nucleon to nitrogen ions. Following the successful experiments with this prototype, in 1980 the project for a linear collective heavy-ion accelerator in which the ions would attain an energy of 20 MeV per nucleon was approved. On the Czechoslovak side, UJF CSAV in Rez and the Institute of Electrical Engineering, SAV, Bratislava are cooperating with the department. Each of these organizations is currently represented by one member on long-term assignment. This cooperation extends to the following tasks:

1. investigation of the formation, compression and preacceleration of the electron rings;

2. investigation of electrodynamic acceleration of the electron ring.

The Institute of High-Energy Physics

This institute belongs to the USSR State Commission for Peaceful Uses of Atomic Energy and is located in the town of Protvino, near Serpukhov, about 130 km south of Moscow. This is a Soviet national laboratory, but by agreement it makes extensive experimental opportunities available to the physicists of the Joint Institute.

In 1967, a synchrophasotron accelerating protons to 76 GeV and producing beams of secondary particles with a wide range of energies was put into operation there. Among the major successes achieved at the very beginning of the device's existence was experimental proof that the total effective scattering cross section of protons by protons increases with the collision energy and the confirmation of the existence of nuclei of antitritium and anti-^{3}He. In recent years the attention of the physicists in Protvino has been devoted primarily to the problem of the quark-parton structure of hadrons (strongly interacting particles), to experimental verification of the results of quantum chromodynamics and the like. The institute carries out its experimental program in extensive international cooperation with leading foreign institutes working in high-energy physics, such as CERN in Geneva, the French National Nuclear Research Center in Sacalay, the Fermi Laboratory in Batavia, near Chicago, and so on.

The cooperation with the SUJV, already mentioned, plays an important role in the system of cooperative activities of the Institute of High-Energy Physics. The physicists of the Joint Institute are carrying out a number of complex experiments on the beams of accelerated particles from the synchrophasotron in Protvino. For example, currently 15 large devices or sets of apparatus built by the Joint Institute are installed at Protvino.

In recent years, problems associated with further expansion of the experimental facilities have been discussed in detail by the Institute of High-Energy Physics and the SUJV. The result of this analysis was a proposal to build a new accelerator which would accelerate protons to energies above 1,000 GeV. With this accelerator it would be possible to create beams of various types of

secondary particles. The high intensity of the proton beams (about 6 x 10^{11} particles per pulse) would make it possible to produce not only the traditional beams of pions and kaons, but also beams of "exotic" particles such as sigma hyperons and other hyperons, neutrino beams and the like. The experimenters would thus gain new, extraordinarily broad opportunities. The project calls for the creation of an additional storage ring in which it would be possible to accumulate and accelerate not only protons but electrons or antiprotons, and thus to create colliding beams of various types of particles.

The project offers the prospect of more profound study of the laws of the microworld, raises the maximum attainable energies and also makes it possible to study the interaction of elementary particles at smaller time-space distances than before. The Presidium of the USSR Academy of Sciences and the Soviet government have agreed to begin construction of this accelerator complex. The work is expected to be completed in 1988. Even now the detection system for experiments on the new accelerator are being prepared at Protvino and in the SUJV, and the problems which this installation would help answer are being formulated.

A Brief Word on the Prospects for Development of the Joint Institute

The Assembly of Plenipotentiary Representatives and the Scientific council of the SUJV devote constant attention to questions of the further development of the institute and its international cooperation. Recently a general plan for the development of the institute through 1990 was prepared, discussed and approved.

According to this plan and the plan for the next 5-year period, the next few years will be marked by a qualitatively new stage in basic research on the structure of the atomic nucleus, the physics of elementary particles, and condensed matter in the SUJV. It will make the fullest possible use of such newly-constructed unique devices as the IBR-2 pulsed reactor, the U-400 isochronous cyclotron and the large-current cyclotron, allowing investigators from the socialist countries to pursue research at the highest international standards.

The most important project of the next five-year plan will be the beginning of construction of the ion accelerating complex in Dubna. This installation will determine the direction of development of physical research in the SUJV for several decades to come. This accelerator will be built with the cooperation of the Kurchatov Institute of Atomic Energy in Moscow. Also of importance will be the SUJV's cooperation in the construction and use of the accelerator and storage complex which the USSR will begin to build during the next five-year plan at the Institute of High-Energy Physics in Protvino.

Czechoslovak scientists and engineers will continue to contribute to the successful fulfillment of the SUJV's tasks. The idea of concentrating our participation on selected critical scientific research programs at the SUJV and of establishing organizational connections with programs in the Czechoslovak State Plan for Scientific Research have justified themselves. The preparation of the next five-year plans by the SUJV and in Czechoslovakia has offered further opportunities to strengthen international scientific and technical integration in the basic research coordinated by the Joint Institute.

Prizes of the Joint Institute of Nuclear Research for Best Scientific Research Awarded to Collectives with Czechoslovak Participation

1. Development of a method for studying elastic scattering of protons and high-energy pi mesons by protons and nuclei in the Coulomb interference range, discovery of constructive interference in proton-proton scattering, and investigation of the relationship between the real part of the amplitude of elastic proton-proton scattering and the energy (1964; Czechoslovakia was represented in the group of authors by J. Korbel and L. Rob).

2. Chemical properties of element 104 (1965; L. Zvara, T. Tvarova).

3. Investigation of the properties of ground and excited states of strongly deformed rare earth nuclei (1966; M. Finger, H. Hnatowicz, J. Urbanec, V. Zvolska, T. Zvolsky).

4. Proposal and development of a new method for measuring the effective resonance mass using a two-channel system along with existing film-type spark chambers and Cerenkov gamma spectrometers, and discovery of electron-positron decay of vector mesons (1967; J. Hladky).

5. The 100-cm hydrogen bubble chamber of the Laboratory of High Energies, SUJV (1968; M. Maly).

6. Alpha-decay of neutron nuclear resonances (1970; M. Florek, J. Kvitek, I. Wilhelm).

7. Cerenkov radiation and its use in high-energy physics (1970; C. Musikar, P. Pavlovic, P. Sulek).

8. The LUDMILA experimental installation for experiments in the Institute of High-Energy Physics, Protvino (1976; S. Vyskocil).

9. Giant resonances in the interaction of medium-energy particles with light nuclei (1977; M. Gmitro).

10. Study of the interaction of pions with small nucleon systems (^{3}He and ^{4}He nuclei) (1977; R. Mach).

11. Investigation of the electromagnetic form factor of pions in quantum chromodynamics by means of dispersion relations (1978; S. Dubnicka).

12. Neutronographic study of crystal structures by measuring time-of-flight (1978; M. Dlouha).

13. A physical complex for studying the decay of short-lived radioactive nuclei, oriented toward very low temperatures (SPIN experimental installation) (1978; J. Dupak, M. Finger, Z. Janout, J. Konicek, J. Rikovska).

14. Fissile neutron-deficient isotopes ^{127}I and ^{167}Tm for nuclear medicine (1978; O. Knotek).

15. An isochronous cyclotron with variable energy (1979; J. Bejsovec, Z. Trejbal).

16. Microprocessor systems in the CAMAC system: development and practical utilization in physics experiments (1979; K. Piska).

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BRIEFS

HEATING FROM NUCLEAR PLANTS--Waste hot water from nuclear power plants V1 and V2 in Jaslovske Bohunice will heat residential areas and industrial plants in Trnava, Leopoldov, Piestany and Nove Mesto nad Vahom. The town of Hlohovec will receive heat in form of steam, from a 600 MW source, which will be utilized by national enterprise Slovakofarma and in fodder production. Other recipient of the heat will be the agricultural and food industry complex in the area of Jaslovske Bohunice, which will utilize it in plant and livestock production. Construction work on the first 22 kilometers of this system is slated for 1983. [Prague ZEMEDELSKE NOVINY in Czech 11 Feb 82 p 6]

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CROATIAN OFFICIAL DISCUSSES SCIENCE, TECHNOLOGY LAG

Zagreb VJESNIK in Serbo-Croatian 13 Feb 82 SEDAM DANA supplement pp 4-5

[Article by Nino Pavic: "Success Cannot Be Achieved by Ordering It"]

[Text] The necessity of going onto world markets, the export orientation of the Yugoslav economy and the certainty that we can establish a foundation for further development only by relying on our own potential rather than through the excessive purchasing of foreign licenses, patents and processes have once again, as back some 10 years or more, made science and technology attractive functions in society.

Two weeks ago the Croatian Assembly adopted the Resolution on Scientific and Technological Policy in SR [Socialist Republic] Croatia. For scientists and people who are concerned with the policy governing scientific and technological progress the decision of the Assembly was a sign of support, but much more tangibly than that, the funds earmarked for these purposes have even this year been increased by about 70 percent. A piece of news that is almost improbable, but only for those who shove science into the domain of "nonproductive investments." To those familiar with world economic development and those who are quite aware of the almost infallible rule of the advanced countries that the benefits of production increase in proportion to investments in development, this measure is simply a stabilization measure.

"What is being allocated to science through the SIZ's [self-managing community of interest] is only a portion of the resources. A sizable potential is also hidden within work organizations. Although we will be using a large portion of the resources we now have at our disposition for science to stimulate research work within enterprises, we still have to wage a fight for considerably larger direct investments. This is a condition for economic survival in the coming medium-term period," says Dr Uros Perusko, professor and chairman of the Croatian Republic Committee for Science, Technology and Information.

"Of the 1.62 billion dinars which have been made available to science this year, we will spend 5 percent to encourage the work and hiring of young scientists and 10 percent to develop science in the regions. The average age of scientists is getting older and older. We will also be vigorous in undertaking to reduce that age and to open up prospects for younger people. It is not enough to furnish

someone a job, though even that can be a problem. We have to furnish the young people instruments, supplies and the opportunity to participate in significant and attractive research."

Benefits Clouded Over

[Question] That means that the material status of our scientists could soon be corrected. Often their earnings have lagged behind those in the economy.

[Dr Perusko] Yes, but experience indicates that those are not the decisive questions. People do not decide to take up the challenge of research because of money. It is much more important to provide conditions for scientific work. Our scientists do not live well, but nor do they live much worse than the other working people. The critical point is up-to-date equipment and supply.

[Question] The Federation of SIZ's for Science of Yugoslavia recently proposed that awards no longer be presented to researchers and innovators, but that they participate in a share of the profit.

[Dr Perusko] As a matter of fact this is a worldwide problem of protecting intellectual work and its results. This is not so simple, since there are no precise scales by which it is truly possible over a long period of time to measure a scientist's performance. Rade Koncar, for example, and we should not forget that research work has been organized in an almost exemplary way in that organization, has decided to monitor the benefits of innovations for only 2 years after a new product is put into production. They established that inflation and altered market conditions so cloud over the effects that there is no point in monitoring them. As a rule the results of a scientist's work lie in past labor rather than in present labor. That is why a portion of a scientist's earnings ought to be current, but the other should depend directly on the results of his labor. But those results are difficult to establish, especially in basic research, where the benefits are discovered only several years later.

Success is never certain in scientific research, regardless of how much money is invested. Success cannot be achieved by ordering it. A great deal of patience and long-term investments are needed for us to be able to hope for any sort of results.

[Question] The effectiveness of science depends in large part on the concentration of potential at the key points of development. Have we today in Croatia and Yugoslavia defined the priorities in scientific research?

[Dr Perusko] There is not yet an altogether precise agreement on this. It is well known that in Yugoslavia we still need to adopt a social compact on the strategy of technological progress. The republics have drafted their own plans for development of science over the next 5 years. It is not enough to say that we will take food, say, as a strategic line of development. A very precise agreement is needed as to which projects must be carried out in this field. We are especially interested in those which can be carried out quickly or those which already promise application. That is why we will support, for example, a method of producing alumina from bauxite with high silicon content which has

already been patented. That means from poor quality bauxite, which is precisely the bauxite we possess. There are other interesting projects in the field of mariculture, certain research with zeolites offered by Rudjer Boskovic, and so on. At present we are still defining priorities. Our intention is more to speed up work on promising projects, to furnish them funds, equipment and staff.

If there are priorities in the world in the field of technological research, then those fields are computers and biotechnology. We are especially interested in biotechnology, since we have the people, initial success and funds for that research. In that field we have some chance in the worldwide race. The investments are not so large that we could not keep pace with our own financial and economic potential.

Exporters of Intelligence

[Question] However, the development of the electronics industry in Croatia is stagnating. There is no mention at all of computer production, though certain other republics have already done quite a bit. We cannot develop without electronics. What will our republic undertake to change that?

[Dr Perusko] That is an enormous problem. The highly developed countries employ about 50 percent of their manpower in the field of processing information. That development is continuing. The trend is formidable. Mastering the technologies of processing information is truly becoming the key question of progress. And what we call physical production is today based on the processing of information. Failing to keep pace with that kind of world development means lagging behind. As with many other things, Croatia has excellent predispositions, but we have not done much to organize production ourselves. However, there is one fact that favors us. Over the last 30 years or so the prices of physical components of computers have dropped to less than one-tenth what they were. The price of mental labor, however, has dropped to only one-third or one-fourth what it was. So, human labor is being valued more and more, and that is our chance. We have the people and the potential. Today software is being exported just like ordinary products are exported. Even Croatia is exporting software. Jugoturbina, RIZ [Zagreb Radio Industry], the School of Electronics at Zagreb University in collaboration with certain Slovenian firms, Nikola Tesla, and others have become exporters of intelligence. But that is not enough. There must be a point of support in material production, there must exist some concrete product, some fruit of our own mind, with which we can compete on the foreign market.

Of the hardware components of the computer, then, those physical components, the only things we do not produce are semiconductors with a high degree of integration. They are manufactured only by one country in the world, and that at a single site, in California. It does not pay to produce them, since they constitute a small portion of the computer's cost, but mastering production would necessitate excessively large investments. However, we are capable of producing other components, for example, disks and printers--TRS [computer factory] has already achieved world quality in its products. We are also producing the simplest things--visual display terminals, power sources, housings, and so on. Rade Koncar's new locomotive is proof that we can produce even the most complicated things. Though the hardware was purchased in Sweden, the software--the control system, is the result of work by our own specialists.

There are two things, however, blocking the way to more serious development of the electronics industry: integration and development. The world electronics industry appropriates 10-15 percent of the total value of its output for development. Our producers, on their own and separate from one another, cannot do this. Research is expensive, and those who are weak and small cannot run the risk. What makes the transnational companies strong is precisely this joint investment in development, purchasing, sales and marketing.

The example of Belgium is interesting. Recently that country has undertaken political decentralization and regionalization. But one of the elements in common and which was not even disputed, were investments in R&D. Or, take the policy of the new government in France. They are significantly speeding up investments in science and development. A ministry for science and technology, which France never had before, is being established.

Ideal Equilibrium

[Question] That means that government investments in science are growing.

[Dr Perusko] Yes, and that, too, is very interesting. Government investments are growing, but not only in government factories, but also private ones. Our method of pooling capital is too haphazard. The Yugoslav community obviously cannot function without joint investments in R&D. The independence of the republic or nationality in culture or language is one thing, but without a joint effort and community consensus in technology, we cannot progress. Of course, that need not be on a governmental basis.

[Question] It is thought by some that in past years we have neglected basic research quite a bit. The undefined status and prospects of the Rudjer Boskovic Institute are usually mentioned as evidence of that.

[Dr Perusko] That institute is unquestionably our largest resource. Since it gave up its consistent nuclear program more than 10 years ago, the institute has been wandering and seeking its place. If we had not given up at that time, today we would be exporters of nuclear technology rather than importers. Certain components of the institute have found their place by working on specific projects and problems. They had been working for Rade Koncar, Jugoturbina, Pliva, and many others. So, there is a readiness for the institute to be involved in technological advances in addition to basic research. However, not a single institute in the world, nor Rudjer Boskovic either, can take over the job of the economy. All it can do is to finalize some discovery to the threshold of practical application. Then things pass into the hands of the experts in the economy. They must prepare production and take advantage of a certain experience. Everything that is being done in the institute today is nevertheless too petty and small. It is time for us to draft a much more ambitious and consistent plan of its work covering a longer period of time. We must relate our ambitions in development to that institute....

[Question] ... And its basic research?

[Dr Perusko] Certainly. But we must guarantee the ideal balance with applied research. We are too poor to get involved in a large number of basic research projects. And even if we were able to bring them to final form, we would not have the economic resources to take them over, and then they would be used by others. Likewise we cannot throw ourselves exclusively to applied research, since without basic research that is impossible.

Ties With Europe

At the moment we are also working on a project of the International Institute for Molecular Genetics which is to be established in Split. In that field we have excellent research, tested personnel and large opportunities. This would be a center of the "transient" type. It would have laboratory and living facilities. We would organize work in it in such a way that the specialists would remain at the institute only while they were working on the project. Many scientists with a world reputation have announced that they would participate in this project. The center has been discussed by the Presidency of SR Croatia, the Executive Council of the Croatian Assembly, the Yugoslav Academy of Sciences and Arts, and so on. They have all given us support. The staff and money have been furnished. It should not be forgotten that this is one of the most promising fields of science in the world.

[Question] If one is to make a breakthrough in the world, one must also be informed about scientific and technological innovations in the world. Some of the republics are setting up their own information systems, and even certain large work organizations like Energoinvest have done quite a bit on this. What is being undertaken by Croatia?

[Dr Perusko] We dare not suppose that we will solve all the problems with a single unified information system, though some people do have illusions about that. For the moment we must develop the individual parts and fit them into a unified network. The national library and university library, as you know, have a patent file, Radio-TV Zagreb is working on its information system, and so on. At the initiative of the Federal Executive Council a plan has been drafted for our inclusion in Euronet, the European information network, which could provide practically all the most recent data on research, markets, production, and so on. We want Zagreb to be the experimental point of Yugoslav inclusion in that system. Vojvodina has a very good information network for data in the field of agriculture and agricultural technology.

Today we are still very far from having too many information systems. We are just in the stage of building them. But what especially disturbs us, unfortunately, is far from computers. Today we are in a situation where we cannot furnish our scientists even the basic working tool--specialized literature. The Executive Council of the Croatian Parliament has issued three appeals to the commercial banks and the SIZ for Foreign Economic Relations for them to finally approve the funds for purchasing books and periodicals in the world outside. So far there have been no results, and yet the amount involved is insignificant.

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EAST EUROPE REPORT
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SUCCESSES IN BIOLOGICAL, CHEMICAL 'WAR' AGAINST PLANT PARASITES

Tirana ZERI I POPULLIT in Albanian 17 Dec 81 p 3

[Article by Ibrahim Baci: "For the Improvement of the Crop Protection Service"]

[Excerpts] The Station for the Protections of Crops in Durres is celebrating its 10th anniversary. During this period this scientific research institute has achieved good results. At the present time, the number one problem of this station is organizing, on more scientific bases, the activity of identifying and detecting agricultural parasites. The example of the agricultural cooperative of Kryevidh in Durres District is being generalized. In this cooperative, which has more than 4,000 hectares of land planted to various crops, damage by agricultural parasites has been reduced considerably, by properly organizing the detection and identification of the parasites and by applying high quality chemical treatments at the proper time. A close collaboration has been established between workers in the Station for the Protection of Crops and specialists in crop protection in the districts and in units in the plains areas, especially in regard to the prediction of infestations by parasites and timely action to combat the parasites.

Currently, our agriculture uses large quantities of pesticides. It is important that they be used with the greatest effectiveness, the workers at the station say. This is even more important in densely planted plains areas where the progressive technologies of cultivation of crops require the efficient use of chemicals to combat soil pests, weeds, etc. It is necessary to use the preparations sparingly (some of them are imported at great cost), in order to treat areas which are as large as possible, without polluting the environment. Workers in this institution are trying to find better methods for using herbicides on corn and cotton. They will increase their collaboration with our machine industry, so that the industry will produce the most advanced types of pumps which will economize on pesticides, reduce work and increase the quality of treatments. Also, as another means of saving pesticides and increasing the quality of treatments they are collaborating closely with the chemical industry for the production of pesticides in very small granules (from 60 to 40 microns).

Tests carried out by workers in the Station for the Protection of Crops show that the use of chemicals in combating diseases of corn stalks has been

accompanied by an increase in yields ranging from 4 to 6 quintals per hectare. In the coming years they will work to put into wide use the scientific data produced in experiments. It is necessary to establish the best manner of treating wheat seeds by combining the necessary substances.

The Station for the Protection of Crops has already had its first successes in the biological war against agricultural pests. In hothouses in the Elbasan agricultural enterprise, the insectivorous phytoseiulus persimilis was successfully used to combat the hothouse spider. The use of biological insecticide against the white mulberry tree butterfly has also produced encouraging results. This insecticide, which is being produced in the biological warfare base of Rrozhbull, has been used with high effectiveness in Fier District against the pine borer. Tests have proven the profitability of using protein slag (produced by the station) to combat the olive bug. Now the aim is to produce strains with high exzymatic power, which will pave the way for the industrial production of protein slag. The extension of the biological war, especially in cases where chemical substances cannot be used, is one of the areas of the work of the employees on this institution.

The perfection of the plant health service requires that crop protection specialists have a better knowledge of the ecology and biology of pests and diseases. The station is prepared to undertake the post-graduate specialized training of these specialists so that they, by increasing their knowledge, will give the best possible service for the intensification of agriculture.

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ADVANTAGES OF HYDROELECTRIC POWER DISCUSSED

AU141022 Bratislava PRAVDA in Slovak 13 Jan 82 p 2

[Article by Frantisek Zdobina, PRAVDA staff journalist: "The Opportunity To Save Millions of Tons of Coal; Renaissance of Small Power Plants"]

[Summary] By more consistently utilizing hydroelectric energy to generate electricity we could save a few million tons of coal annually and use it for other purposes. As a rule, the idea of generating electricity from water resources is connected with expensive water projects. However, there also exists another possibility: reconstructing the old and even building small new hydroelectric plants.

At present, a total of 257 small hydroelectric plants are in operation in the CSSR; some years ago there were almost 15,000 of them. The small hydroelectric plants have many advantages. The cost of electricity they generate is low, the majority of the plants do not require any special attention and they are simple and can be built rapidly. Moreover, our rivers and streams have numerous dams and locks.

For this reason, the federal government has approved several measures aimed at speeding up the reconstruction and stepping up the construction of small hydroelectric plants.

It is obvious that these small power plants cannot cover the production sector's and households' demands for electricity, but their contribution to maintaining a smooth power supply definitely cannot be ignored.

At a press conference held at the Presidium of the federal government on 12 January, experts maintained that in the CSSR the capacity for 1,009 mw could be installed in small hydroelectric plants, with the possibility of generating 3,052 gwh of electric power. In Slovakia, construction of small hydroelectric plants is envisaged on the Hron River and in other localities, such as Lehota, Dobsina and Kremnica.

A total of 725 localities have been surveyed on CSSR territory in which small hydroelectric plants could operate.

CSO: 2402/34

OFFICIAL IN CHARGE OF NEW ELECTRONICS PROGRAM INTERVIEWED

Budapest MUSZAKI ELET in Hungarian No 3, 4 Feb 82 p 3

[Interview with Sandor Mihaly, government commissioner and deputy director-in-chief of the Central Physics Research Institute of the Hungarian Academy of Sciences]

[Text] At its 23 December 1981 session the Council of Ministers passed a resolution on the "Central Developmental Program for Electronic Parts and Subassemblies" or, as it is known more briefly, the Electronics Central Development Program, the EKFP. The resolution handles in a stressed way the most forward looking part of the program, one which affects society as a whole and influences the structure, economicalness and competitiveness of the economy, primarily of industry, namely, laying the foundations for domestic manufacture of microelectronic parts, and it names Mihaly Sandor, deputy director-in-chief of the Central Physics Institute (KFKI) of the MTA [Hungarian Academy of Sciences] as government commissioner to guide it. Zsuzsa Szentgyorgyi, deputy first secretary of the MATE [Measurement Technology and Automation Scientific Association] and a member of our editorial committee, talked with him about the most important questions of the EKFP, and especially the microelectronics program.

[Question] The EKFP, born after long years of gestation, has been greeted by a part of technical public opinion with joy, but there are a number who feel that it is too much of a luxury for a small country like Hungary to build up its own microelectronics parts manufacture. It is true that some large enterprises, such as IBM and Hewlett-Packard, recognized fairly early that they would be at a disadvantage without their own electronic parts manufacture, so they created their own enterprises for internal supply.

[Answer] This is true, and the trend is strengthened by the fact that in the past 2-3 years a number of semiconductor factories (for example, Zilog and Fairchild) have been bought up by large enterprise groups. This is understandable because just as the manufacture of printed circuit boards cannot be centralized--unfortunately the domestic example proved this rather spectacularly--

and most electronics factories produce their own special printed circuit boards, at most ordering from outside firms the boards needed in large numbers, so a somewhat similar situation will begin to develop in microelectronics sooner or later. Especially if we consider that all the functions put on one earlier printed circuit board practically "fit into" one very highly integrated circuit package. In the second place, by the end of the 1970's the cost distribution among the three basic part-technologies for producing microelectronic devices--design (production of masks), wafer manufacture and packaging--changed. As production improves and the number of elements or functions on one wafer increases the latter two part-technologies become specifically cheaper and the share of the first increases--at the same number of units. And the number of units can be increased at will for only a very narrow group of parts.

In 1982: A Microelectronics Enterprise

[Question] Might this mean then that we must strive primarily to produce devices requiring more intellectual work, and not to produce catalog circuits manufactured in large quantities?

[Answer] Yes. We would not be able to manufacture economically and competitively the catalog circuits (for example, memories and microprocessors). In contrast to this--but based on the manufacturing technology for these--we should aim at producing devices requiring more intellectual work, equipment satisfying special user needs or task-oriented circuits. Microelectronic design and manufacture in Hungary will not take place in a vacuum. Research and development, even experimental manufacture, have been conducted and are being conducted in a number of places. For example, they have been dealing with MOS technology and the development of technological measuring equipment at the HIKI [Signal Technology Industry Research Institute] for years and at the KFKI also there is experience in the area of designing MOS circuits and a bubble memory developed here is standing before the experimental manufacture stage. At the Telecommunications Research Institute (TKI) they have developed a circuit and printed board designing-manufacturing-testing (TGE) system. Izzo [United Incandescent] has an integrated circuit assembly-packaging factory in Gyongyos which is modern by European standards and it has its own semiconductor development section. We should also mention the very promising development of GaAs based circuits under way at the Technical Physics Institute of the MTA.

[Question] Perhaps this nice, long list is a little too long for such a little country.... How will this lead to a united development and manufacturing base?

[Answer] An essential link was left out of the list--trade, which is now performed by the Elektromodul (EMO) enterprise. According to the goals of the EKFP the entire chain--from research and development through manufacture to trade and market research--must be integrated into a single unit, following the example of successful semiconductor manufacturing firms. In this spirit the Council of Ministers decided that by the beginning of this year we must establish a Microelectronics Enterpirse, the chief components of which will be made up of the appropriate developmental and experimental manufacturing sections of United Incandescent and the Signal Technology Research Institute. These will be joined by the research and development units from the TKI and the KFKI which deal with circuit design, in the course of 1982-1983. Later the Gyongyos semi-

conductor factory will join the Microelectronics Enterprise also. In the first quarter of this year the new enterpirse and its research and marketing units (for example, the EMO) will form a research-development-production-marketing association.

Custom-Made Circuits

[Question] On what technological base will production begin?

[Answer] For the time being there will be experimental manufacture, up to 1984. Wafer manufacturing technology will be solved by purchasing licenses and equipment obtainable on the socialist market. Equipment and domestic experience are now available for design; these should be expanded or developed further. It is well known, for example, that four of our large enterprises--the MMG [Mechanical Measuring Instruments Factory] Automatic Works, the Telephone Factory, the EMG [Electronic Measuring Instruments Factory] and the BHG [Beloiannisz Signal Technology Factory]--are already using the AUTER electronics designing system. We should expand and tool up for these, including the designing system at the HIKI, and with their aid anyone from industry can design integrated circuits by 1983.

[Question] What sort of expert need must we count on after gearing up, by the 1990's?

[Answer] In contemporary electronics it is less and less possible to separate the traditional "parts manufacturer" from the "equipment manufacturer." Even those manufacturing devices must be able to design--or at least specify--the technically and economically most favorable circuits suiting their own tasks. A few years ago a trend got started in the industrially developed countries which unites the advantages of cheap, quickly accessible, mass produced catalog circuits with equipment-oriented devices better suiting the special needs of a user (but relatively more expensive and more "unique"). These so-called ULA circuits (from the English, Uncommitted Logic Array) are made so that a few basic layers (functions, function elements) on the chip are mass produced and the final layers and connections are put together according to the unique desires of the purchaser. Making use of a simile I might say that this is like a semi-finished suit made by the ready-made clothing industry but adjusted to the size of the purchaser, with "custom-made" sewing. Thus, to return to the need for experts, we might say that by the 1990's we must prepare electronics experts following a different view than that to which we are accustomed. If we make an estimate in this way then the branch will need 3,500 to 4,000 graduates.

[Question] Where will these "consumers" circuits be used first?

[Answer] There are already domestic beginnings. The most significant of them is that of the Signal Technology Cooperative which produces, as jobwork, task-oriented (or to use the widespread English expression, custom-made) circuits for equipment being made abroad. Since they already have experience the Hir-Szov [Signal Technology Cooperative] has received support to begin using ULA's with domestic resources.

[Question] Beginning experimental manufacture, especially circuit design requiring a large expenditure of intellectual work, will require significant research and development activity. What relationship does the EKFP have to the research and development programs?

[Answer] The microelectronics part of the EKFP is linked to a number of national research and development programs, or incorporates a number of them. In the latter category we have the A/4 program of the National Medium-Range Research and Development Plan (OKKFT) which is a complex program for the development of microelectronics parts manufacture and has four sub-programs for design, adaptation and introduction of manufacturing technologies and covers other longer range research and development work. The program is closely linked to the K/7 program of the National Long-Range Scientific Research Plan (OTTKT) and to the A/6 program of the OKKFT. The latter deals with the chief developmental questions of domestic use of computer technology and, within this framework, with industrial introduction and further development of electronic TGE [designing-manufacturing-testing] systems. In addition, these programs are being carried out with the cooperation of a number of ministries or chief authorities (the MTA, the National Technical Development Committee, the Ministry of Industry, the Central Statistics Office).

[Question] How are our developmental programs linked to international cooperation?

[Answer] The EKFP is based to a large extent on utilization of intellectual products and information which can be obtained via international cooperation. The program is open in that we will systematically build in new achievements of technical development and information which can be obtained in international cooperation. I would like to point out especially that we expect significant results from that cooperation which was the subject of an agreement signed in July of last year by the premiers of the CEMA countries in regard to joint development of electronic parts, technologies and technological equipment.

The Possibilities of the MTESZ [Federation of Technical and Scientific Associations]

[Question] It is perhaps not well enough known that the social forums of experts were the first to call attention to the problems and tasks of domestic electronics technology development and especially parts supply. More than 7 years ago the Signal Technology Scientific Association--in cooperation with other associations interested in the theme, the Hungarian Electrotechnology Association, the Measurement Technology and Automation Scientific Association and the Janos Neumann Computer Sciences Soceity--took the initiative in pointing to the need for a solution at the national level of this problem which profoundly influences our entire economic development. So let me ask your opinion: How can the MTESZ and its association aid or cooperate in the successful realization of the electronics program?

[Answer] We know very well that one of the five central programs being stressed by the MTESZ deals with electronics. The support of the social forums of experts--we might say of technical public opinion--has meant great aid already in

the preparatory work. It is extraordinarily important that there also be that change in view required by the new technology; otherwise the new types of tools could hardly be used. We are counting on the effective cooperation of the associations in getting this new view adopted in education, in further training and especially in industry. It is very important that professional public opinion be regularly informed of technical changes and developments taking place in the electronics industry and that we receive appropriate feedback.

[Question] I thank you for the interview and I feel that what you have said also counts as a significant step in orienting professional public opinion.

8984
CSO: 2502/53

STUDY OF TRANSPORT PROCESSES IN MEMBRANE SYSTEMS BY THE RADIOACTIVE INDICATION METHOD. PART II. STUDY OF THE ION-TRANSPORT PROCESSES TAKING PLACE IN ION-EXCHANGE MEMBRANES, PHOTOGRAPHIC MATERIALS, AND PLANTS BY THE RADIOGRAPHIC METHOD

Budapest MAGYAR KEMIAI FOLYOIRAT in Hungarian Vol 87, No 10, 1982 pp 441-450

VARRO, TIBOR, and MADI, ISTVAN, Isotope Laboratory, Kossuth Lajos University of Sciences, Debrecen, and SOMOGYI, GYORGY, Nuclear Research Institute, MTA [Hungarian Academy of Sciences], Debrecen

[Abstract] The ion-transport processes taking place in various Hungarian- and foreign-made membranes (based on polystyrene sulfonic acid), FORTE and other photographic papers, and plants (carrots and potatoes) were examined by a radiographic method involving the use of polycarbonate, cellulose nitrate, and polyallyl diglycol carbonate solid-state trace detectors for alpha-radiograpgy, irradiation with 14 MeV neutrons, and determining the fission products of the U(n,f) nuclear reaction by preparing the fissionograms (the boron-containing samples were irradiated at a thermal neutron flux of 2.10^{11} neutrons/cm^2 and preparation of the radiograms of the alpha particles formed in the $^{10}B(n,\alpha)^7Li$ nuclear reaction. The primary purpose of the study was to evaluate the suitability of the method described. The findings indicated that the diffusion and flow processes could be clearly distinguished and that the diffusion coefficients could be determined at a standard deviation of 20-30 percent. The findings were presented in tables, diagrams, and radiographs. Figures 9, tables 12, references 11: 1 Hungarian, 1 German, and 9 Western.

2542
CSO: 2502/46

STUDY OF TRANSPORT PROCESSES IN MEMBRANE SYSTEMS BY THE RADIOACTIVE INDICATION METHOD. PART I. STUDY OF THE ION-TRANSPORT PROCESSES TAKING PLACE IN ION-EXCHANGE MEMBRANES, PHOTOGRAPHIC MATERIALS, PLANTS, AND SOILS BY THE RADIATION-ABSORPTION TECHNIQUE

Budapest MAGYAR KEMIAI FOLYOIRAT in Hungarian Vol 87 No 10 Oct 81 pp 441-450 manuscript received 8 Aug 80

VARRO, TIBOR, and MADI, ISTVAN, Isotope Laboratory, Kossuth Lajos University of Sciences, Debrecen, and SOMOGYI, GYORGY, Nuclear Research Institute, MTA [Hungarian Academy of Sciences], Debrecen

[Abstract] The ion-transport processes taking place in ion-exchange resins (Amberlite IRC-50, made by Rohm and Haas Co., and K1 membrane, Hungarian-made), soils (clayey, sandy, and saline, from various areas of Hungary), plants (leaves, shells, roots, and seeds), and soil ingredients (H and Na montmorillonite, and H, Na, and Ca bentonite) were examined by a method based on the paper of Kryukov et al (Dokl. Akad. Nauk SSSR Vol 90, 1953, p. 379), using a variety of radioactive isotopes, including ^{14}H and ^{3}H which provide soft beta radiation. The primary purpose of the study was to evaluate the suitability of the method described. The findings indicated that the diffusion coefficients could be determined at an error of 20-30 percent in the range of 10^{-9} to 10^{-18} m^2/sec^{-1} range. The diffusion coefficients measured for numerous ions in the materials studied were presented in tables and diagrams. Figures 7, tables 19, references 13: 4 Hungarian, 3 German, 1 Russian, and 5 Western.

2542
CSO: 2502

EFFECT OF THE CLASS RANGE ON THE RELATIVE ERROR OF THE MEAN VALUE AND SCATTER OF THE PARTICLE-SIZE DISTRIBUTION OF POWDERED PESTICIDES

Budapest MAGYAR KEMIAI FOLYOIRAT in Hungarian Vol 87 No 11 Nov 81
pp 510-514 manuscript received 3 Oct 80

CSERHATI, TIBOR, Pesticide Research Institute, Budapest; and PETRO, EDE, Pesticide and Agricultural Chemistry Center, MEM [Ministry of Agriculture and Food], Budapest

[Abstract] Studies were carried out to establish the effect of the class range (1, 2, and 5 μ, most frequently used class ranges) on the relative error of the mean and scatter, and to find out whether there is any relationship between the relative error on the one hand, and the particle-size distribution and the specific class range. The tests were made on the pesticides "metilazinfosz" (0,0-dimethyl-S-(4-oxo-1,2,3-benzo-triazinyl-3-methyl)-dithiophosphate), "dinoseb-acetat" (2-(methyl-propyl)-4,6-dinitro-phenyl-acetate), "linuron" (N-(3,4-dichloro-phenyl)-N'-methoxy-N-"-methyl-urea), and "tetraszul" (2,4,4,5-tetrachloro-diphenyl sulfide). The systematic errors measured were not affected by the number of samples tested if the number was above 500; the error of the scatter increased logarithmically with increasing scatter; the error of the mean value was significantly affected by the scatter; and the relative error of the scatter was relatively unaffected by the mean value. A trivariant function was presented to illustrate the relationships involved. The findings contribute to the optimization of the powder characteristics for successful application of the pesticides. Tables 6, references 5: 1 Hungarian and 4 Western.

2542
CSO: 2502/47

ELECTRONICS AND ELECTRICAL ENGINEERING HUNGARY

NEW TYPES OF TERMINAL AND CONTACT SYSTEMS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 20 No 12 Dec 81 pp 361-371

SZALAY, MIKOLS, Dr, scientific consultant, Central Physics Research Institute, Budapest

[Abstract] The author describes some new terminal and contact systems for electrical installations and equipment, primarily of Western origin. The following are discussed: (1) Split-barrel terminations, available in the form of inverted "U" shape, cylindrical shape, and "U" shape. Most of these terminations are manufactured by AMP Incorporated. They are highly vibration-resistant and durable, and are superior to piercing terminations. (2) Scotchflex experimental card contats, manufactured by 3M Electronic Products Division. The use of these contacts saves about half of the manual labor compared to earlier approaches. (3) Integrated circuit sockets and contact sleeves, available from various sources, such as Robinson-Nugent, Fischer Electronic, AMP, and Cambion. (4) "Magmate" contact and joining system for thin wire coils, manufactured by AMP Incorporated. This system employs piercing, and has many advantages over earlier approaches. The purpose of the article is to draw these new developments to the attention of Hungarian designers since they could be useful for their tasks. Figures 20, tables 6, references 8: 5 Hungarian and 3 Western.

2542
CSO: 2502/45

UDC: 62.001.23-52:681.3

AUTOMATED ENGINEERING DESIGN SYSTEMS (AMT)

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 12, 1981, pp 441-447
manuscript received 1981

SOMLO, JANOS, Dr, and SZENTAI, ENDRE, Dr, Computer Technology and Automation Research Institute, MTA [Hungarian Academy of Sciences], Budapest

[Abstract] The authors review the status and trends of automated engineering design systems with special emphasis on Hungarian and socialist activities and cooperative efforts. The following subjects are covered: Machine designing in cooperation with Soviet institutions, design procedures for the building industry based on Siemens computers, electronic equipment designing systems developed primarily in Hungary, control system designing based on modifications of Western developments, and equipment used in automated designing, where Hungary is still behind some other socialist countries. Among the outstanding Hungarian developments, the article discusses in some detail the AUTER-MPC system, which was developed by cooperation among Hungarian research institutions and industrial enterprises. This system has been used with success in numerous design tasks for electronic equipment. Some recent Western developments in the subject area are briefly discussed. Figure 1, references 10: 1 Western and 9 Hungarian.

2542
CSO: 2502/42

UDC: 65.012.2:681.3.049.77

PRIMARY CONSIDERATIONS IN THE DEVELOPMENT OF THE MICAD MICROELECTRONICS-BASED COMPUTER DESIGNING SYSTEM

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 12, 1981 pp 448-450
manuscript received 14 Sep 81

JAVOR, ANDRAS, Dr, Central Physics Research Institute, Budapest

[Abstract] The MICAD (Microelectronics Intelligent Computer Aided Design) system was developed at the Central Physics Research Institute with the following goals in mind: To provide maximum assistance to designers of integrated circuits by problem-oriented and convenient man-computer communitations. To provide hierarchic systems for the layout cells by means of highly integrated (LSI/VLSI) devices. To provide maximum possible interactivity (the subsystem concerned features GD'71 and TPA70 hardware). To provide simulation close to reality. To provide maximum practicable reliability for the control of the mask-making devices. To provide fast throughput for the system-oriented circuits (this necessitated the development of effective automated connection-designing subroutines, beyond the potentialities of the cell library). In developing the system, two basic goals were kept in mind: 1. Development of basic cells and using these to assemble cells of greater complexity of hierarchic character, so that the latter cells can be used in various areas. 2. Development of highly complex circuits with the aid of the basic cells. MICAD systems already operate satisfactorily in Hungary and abroad. References 10: 6 Hungarian and 4 Western.

2542
CSO: 2502/42

UDC: 621.3.049.77.001.23:681.3.06-52

AUTOMATIC CONNECTION-DESIGNING PROGRAM FOR INTEGRATED CIRCUITS

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 12, 1981 pp 451-454
manuscript received 14 Sep 81

BORSOS, ISTVAN, and TEBY, ATTILA, Central Physics Research Laboratory, Budapest

[Abstract] An algorithm was developed for automated designing of the connections in integrated circuits. It provides a 100 percent completed design, so that no time-consuming and difficult positioning of missing connections is required. This is achieved by utilizing the free area-exploitation principle, which minimizes the wiring area rather than the conductor length. The algorithm is fast, so that a pattern is completed within a few minutes, enabling the designer to try various versions within a short period of time. Relatively little capacity is required, so that the algorithm can be used when based on small computers such as the TPA 11/40. The program based on the algorithm is part of the MICAD (Microelectronics Intelligent Computer Aided Design) system, and operates as part of same. The program then designs the connection layout of the circuit simulated by the LOBSTER program, and then the DOLPHIN program prepares the corresponding mask drawings or the pattern-generator control tapes. The following input data are required: cell type, connection start and end, supply wires, cells per column, sequence of cells in the column, cell separation in the column, and external connections. The program is scheduled for implantation in the 64 kbyte memory of the TPA 11/40. Figures 2, references 12: 2 Hungarian and 10 Western

2542
CSO: 2502/42

UDC: 519.876.5:681.3.06:537.3

NEW SERVICES OF THE TRANZ-TRAN CIRCUIT-SIMULATION PROGRAM

Budapest MERES ES AUTOMATIKA in Hungarian Vol 29 No 12, 1981, pp 465-468
manuscript received 14 Sep 81

SZEKELY, VLADIMIR, Dr; TARNAY, KALMAN, Dr; and RENCZ (Mrs. KERECSEN), MARTA, Department of Electronic Components, BME [Budapest Technical University]

[Abstract] A new version of the TRANZ-TRAN simulation program (designated TRTR81A) was incorporated recently in the MICAD (Microelectronics Intelligent Computer Aided Design) system. The modifications are the following: The capacity of the program was increased to a maximum of 100 nodal points and a maximum of 500 branches (to permit the handling of circuits containing more than 15-20 MOS transistors, specifically up to 70 MOS transistors or approximately 160 bipolar devices). Additional model versions (ENHANCEMENT, DEPLETION, EXTERNAL) can now be called up (to reduce the dependence of the threshold potential on substrate potential, and to permit consideration of the effects of channel shortening). The transistor's heat-generation and warming-up characteristics can now be included in the computations. A new bilinear current generator was incorporated (to facilitate the solution of additional problems). With the aid of the graphic postprocessor and the LOBSTER parameter identifier, the new version of the program is more versatile, faster, and more convenient to use. Figures 3, references 13: 10 Hungarian and 3 Western.

2542
CSO: 2502/42

ATTENUATION BY ATMOSPHERIC ABSORPTION AND ITS CONSIDERATION IN THE DESIGNING OF MICROWAVE NETWORKS

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 9, 1981 pp 341-358

CSERNOCH, JANOS, graduate physicist, scientific and engineering consultant, university lecturer, ORION Radio and Electrical Enterprise, Budapest

[Abstract] The following are the primary causes of fading caused by atmospheric factors: the physical and chemical parameters of the atmosphere (nitrogen, argon, carbon dioxide, and trace gases), atmospheric moisture (water vapor and droplets), and so forth. Theoretical expressions were derived for the characterization of the effects of these parameters alone and in combination. The application of the expressions in the designing of a star-patterned digital network was discussed. Such networks maintain communications among microwave terminals via a central microwave facility. In designing such networks, consideration must also be given to interferences caused by adjacent RF channels over the same RF channel, directional antenna characteristics, overreach interference, and interference resulting from external connections. An example illustrates the use of the theoretical considerations in a system consisting of transmitters, receivers, antennas, antenna wires, and miscellaneous accessories. Figures 14, references 10: 3 Western and 7 Hungarian.

2542
CSO: 2502/49

PROTECTION OF MICROWAVE RELAY EQUIPMENT FROM HIGH-FREQUENCY INTERFERENCE FIELDS

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 11, 1981 pp 428-431

MODER, ISTVAN, graduate electrical engineer, microwave development engineer, ORION Radio and Electrical Enterprise, Budapest

[Abstract] Electromagnetic interference is coupled to microwave relay equipment via galvanic connection, inductive connection, capacitive connection, and radiation connection. Methods for protecting microwave relay equipment from such interference include shielding, filtration, grounding, and circuit-engineering measures such as symmetrization, use of differential amplifiers, and use of interference-resistant coupling circuits or optoelectronic devices. The high-frequency interference fields represent a special problem. ORION has developed special equipment for the latter interference, which was tried in a 24-channel FM system. The equipment consists of a head frame (closed container on the roof or a special mast, connected to the antenna via a short cable. The container accommodates the RF, IF, and modulator units) and a ground frame, located near the control room (It is also a shielded construction, accommodating the baseband, service, remote-control, and testing equipment). The two parts are connected by a cable which may be 30-100 m long. The head frame contains one interference filter, and the ground frame contains two. The equipment is illustrated with wiring diagrams. While it is expensive, it performs satisfactorily. Figures 8, references 2: 1 Western and 1 German.

2542
CSO: 2502/51

ADVANCES IN POLISH SCIENTIFIC RESEARCH NOTED

New Nuclear Physics Agency

Warsaw RZECZPOSPOLITA in Polish 15 Jan 82 p 3

[Text] On 14 January 1982, the members of the Technical Progress Science Commission and the Legislative Work Commission, at a joint meeting under the chairmanship of Witold Zakrzewski, held discussions on a draft law on the formation of a State Nuclear Physics Agency. This is already the second presentation of this project by the government. Last year, the commission's discussions were suspended until the final version of the project was clarified. At this meeting, the text of its statute was adopted unanimously. The State Nuclear Physics Agency (PAA) will carry out the mission of a central organ of state administration in the field of nuclear physics. The area of PAA activity includes research and application from atomic physics in the national economy, the production of nuclear equipment and devices, radioactive materials and handling of same, radiological protection and nuclear safety along with the neutralization and storage of radioactive wastes. Among the matters under its jurisdiction are the licensing and control of the use of all nuclear facilities and devices within the scope of nuclear safety and also participation in the implementation of defense tasks, the issuance of clearances for key personnel employed in nuclear installations and supervision of the execution of assignments by its subordinate branch organization units.

Representatives of the Ministry of Mining and Power Industry; the Ministry of Science, Higher Education and Technology; the Ministry of National Defense; the Ministry of Health and Social Welfare; and the Ministry of Chemical and Light Industry took part in the deliberations. Jerzy Minczewski, Jan Kubit, Mieczyslaw Serwinski, Tadeusz Oriof, Lidia Jackiewicz-Kozanecka, Adam Lopatka and Jerzy Bukowski spoke during the discussions.

In the discussions they noted the important matters of environmental protection, negligence in the area of fuels and energy, the insufficient utilization of nuclear technology in agriculture for the production of phosphorus fertilizers, and the provision of basic pharmaceutical and health care supplies and medical equipment for health care establishments.

Jerzy Minczewski, representative of the minister of the government for nuclear physics, emphasized that since the beginning of industrial nuclear power engin-

eering in the world, the design, construction and operation of nuclear electric power plants and heating plants have been under the management of state economic-type ministries or industrial concerns. However, the supervision of the entire investment process and of operation is under the control of independent state organs of the type proposed in the Statute of the State Atomic Physics Agency.

Protein Production, Consumption Research

Warsaw RZECZPOSPOLITA in Polish 17 Jan 82 p 4

[Text] A recent subject of analysis was the implementation of the government research and development program "PR-4" ("Optimalization of the Production and Use of Protein"). The government program "PR-4" was the first on the list of seven programs in the Council of Ministers Resolution No 266/74 dated 16 November 1974. However, the coordination plan for "PR-4" was approved on 29 April 1977 by the Presidium of the Government (Decision No 48/77); the increase of the production of food and fodder protein was recognized as the main goal on the road toward maximum utilization of available protein sources and the creation of new sources.

The total actual outlays from 1976 to 1980 for the implementation of this government program amounted to over 2.3 billion zlotys. However, in the confirmed coordination plan, outlays of 2.9 billion zlotys were adopted for research and development. Simultaneously, 15.4 million slotys in Western foreign exchange currencies was earmarked for this work, but only 2.5 million foreign-exchange zlotys of this amount was used.

As reported by the Institute of Animal Husbandry, the unit coordinating the first stage, the effect of the work carried out so far in the scope of the government program has been the development and production of 14 new varieties of grain and fodder crops, 8 new fodder and food industry products and 47 technological processes for producing fodder components, methods of storing fodder, agricultural engineering of fodder and food crops, the production of protein food products and new or imporved marine fishing systems.

Also, 18 improved systems were found for feeding livestock, for fodder formulas and for proven nutritional standards. The result of the work within the scope of "PR-4" consists of 37 technological characteristics of new species of ocean fish and cephalopods from new fishing regions and 15 new or imporved designs of equipment, cutters and ships.

The theses for the "PR-4" program (from 1975) anticipated the production of 200,000 tons of protein in 1980 as a result of the implementation of the research and development work. As shown by the analysis under the aegis of the Ministry of Science, Higher Education and Technology, whereas in the coordination plan for "PR-4" a total yield of 312,000 tons of protein was anticipated, in 1980 the results of the work made it possible to obtain 238,000 tons of fodder protein due to an increase in its production and efficient measures for its consumption. Thanks to this research, 40,000 tons of food protein was also obtained.

The second stage of implementation of the government program "PR-4" from 1981 to 1985 forecasts, among other things, a yield of 483,000 tons of fodder protein. In order to reach this goal, the earmarking of over 3 billion zlotys is anticipated for research and development.

The second stage of the large-scale research program "PR-4" ought to bring, among other things, 10 new varieties and 15 species of fodder plants, 26 agrotechnical systems and regionalizing of fodder crop growing, 20 mix formulas and systems for feeding livestock and 15 technological processes for producing raw materials and fodder components. Also, new methods of conservation of grain seed and fodder crops, 16 genetic breeding problem solutions and 4 industrial methods for food products are expected to be found.

The research work within the framework of "PR-4" integrates the scientific developmental centers, the higher educational institutes of six ministries, and the institutes of the Polish Academy of Sciences.

Ultrasonic Microorganism Disintegrator

Warsaw RZECZPOSPOLITA in Polish 19 Jan 82 p 5

[Article: "Complicated Cell Research--Cooperation between the Polish Academy of Sciences and the USSR Academy of Sciences"]

[Text] During the current crisis, both economic and social, many agreements, links and contracts were disrupted. However, there are institutes and entire fields where such manifestations did not occur, or were rather limited in scope. Such is the case in numerous scientific centers, which, in spite of a lack of resources along with other difficulties, have been carrying out their research obligations in regard to foreign scientific partners.

Several years ago a program was initiated of multilateral cooperation between the academies of sciences of the socialist countries in the field of development and production of scientific research equipment and the automation of scientific research from 1970 to 1985. In this program, the areas of so-called specialization for individual academies were also defined. In the very framework of this program, the Experimental Plant of TECHPAN (Institute of Basic Technology Problems of the Polish Academy of Sciences in Warsaw) developed an ultrasonic microorganism disintegrator (type UDM--10), which, in conjunction with flow, thermostat and control systems developed in the Special Design Bureau for the Development of Biological Equipment of the USSR Academy of Sciences in Pushchino, forms a system that makes it possible to conduct unusually complicated internal cell research.

This system, the prototype of which will undergo operation research in 1982 at the research centers of the Polish Academy of Sciences and the USSR Academy of Sciences, makes possible a considerable expansion of the scope of biochemical, microbiological, molecular-biological and immunological research.

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25 March 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 736

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EAST EUROPE REPORT

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INTERNATIONAL TRANSFER OF TECHNICAL KNOW-HOW DISCUSSED

Warsaw SPRAWY MIEDZYNARODOWE in Polish No 6, Jun 81 pp 73-88

[Article by Dr Ryszard Rapacki, lecturer at the Faculty of Foreign Trade of the Main School of Planning and Statistics [SGPiS]: "International Transfer of Technical Know-How"]

[Excerpts] In traditional formulations, the international transfer of technology is widely considered as the sum of human, material and nonmaterial forms of a transmittal (carrier) of a good, independent of the degree of processing technical know-how and the role it plays in the production process.[1] Thus, it links somewhat artificially into qualitatively different categories and blurs the division between the different, separate fields of international economic relations.[2]

If one looks at the phenomenon of transforming technical know-how into an independent object of international trade through the prism of the wider process--the internationalization of production--then one must conclude that the international transfer of technical know-how is the product of a longer historical evolution and is an indication of the passage of the internationalization of a production process to a new, qualitatively higher phase. In this process, one can observe a logical line of development based on the gradual inclusion in international trade of increasingly more complex phases of manufacturing and also an increasingly wider scope of goods (and not just final goods) as well as the factors of production needed for their manufacture.[3] One of the latest indications of the internationalization of man's production activity is not the diffusion of individual goods or production factors from country to country but of entire areas and branches of production seeking the most advanta[illegible] operating conditions (so-called redeployment).

As with international trade, technical know-how occurs not--as previously--embodied in final products produced with its help or in the qualifications and experiences of people but independently--in a form coded with the aid of certain information symbols, conditioning the undertaking of specified production (patented inventions) or the know-how resulting from it.

Taking into consideration the new qualitative characteristics of the present phase of development of international economic relations, it appears desirable to differentiate between the international trade of technology in the traditional, widely accepted formulation (where conventionally most fields of international economic relations are generally accepted, such as the flow of capital

and labor, the fraction of world trade and the like) and the transfer of technical know-how in the strict meaning of the word. In this second formulation the production function of technical know-how as an independent production factor, its specificity as a good of a nonmaterial character and its homogeneity as an "intellectual" good, not directly related either to material objects or to the qualifications and production experiences embodied in man, clearly stand apart.[4] Thus vanish the difficulties associated with separating the contribution of technical know-how from the value of materials and design--the production of which the know-how was used--as well as executing a similar operation to establish the role of science and "learning through doing" in the case of work force qualifications. As a result, only technical know-how in the pure form that is qualitatively homogeneous and occurs as an independent, unbound production factor is, strictly speaking, an object of transfer on an international scale. Most often it is transferred from country to country by means of licenses, part of which could consist of patented discoveries, usable designs or trademarks (patent licenses), and then again another part could consist of unpatented production experiences or production secrets associated with production set up, organization and the like (know-how license).

An international market for such a defined good differs greatly from markets for other goods (for example, investment goods) or factors of production (the market for "experts," the capital market) that are considered in a wider sense as a carrier of technical know-how transfer.

The designation "transfer of technology" is used universally, which implies a certain neutrality regarding the phenomenon of shifting technical know-how from one country to another, frequently of different sociopolitical systems, cultural traditions and the like. However, some authors concerned with this problem state that the transfer abroad of technical know-how is not neutral from the viewpoint of the effect on the new socioeconomic setting. In their opinion, foreign technology is an instrument for realizing the designated political and economic interests of the owner and also is a source for the transmittal of ideas, cultural and civilizing patterns, a hierarchy of values and consumption patterns that are not always beneficial to the societies and countries receiving the technology.[5] This (and not this alone) suggests that the word "transfer" be replaced by the concept of commercialization of technology, which would be more appropriate to the essence of these phenomena.[6] However, it seems that the problem depends not on onomastics alone (all the more so since the question of the commercialization of technology refers mainly to relations among countries that create a large technical and economic gap) but on properly interpreting and reading the essence of certain concepts and considering the phenomena in the economic policy associated with them.

One can look at the international transfer of technical know-how from still another point; that is, as a process wherein technical know-how is gradually diffused worldwide regardless of the form in which it is executed, the methods of legal regulation (for example, the existence or lack of patent rights in the case of know-how) and the subjects performing it. With such an approach this process represents the third element of the famous Schumpeter triad: invention--innovation--imitation.[7] New inventions and technical solutions are initially applied to production in one country (innovation), but after a certain

period of time (known in the literature as imitative creep or the imitation gap) they are also disseminated in other countries.[8] This process is ordinarily called the diffusion of technical know-how or innovative imitation.[9]

Characteristics of International Transfer of Know-How

The international transfer of technology, identified with international license trade, ordinarily resolves itself into an aggregate of events (a tendency) occurring in the international license market.[10] This is not entirely accurate.

First, not all technical know-how that is the object of transfer is drawn into the orbit of market action. Certain of its elements can be transferred on non-commercial bases (for example, cross-licensing operations) or also gratuitously.[11] For this reason the statement is heard that the visible part of the international transfer of technology (that reflected in the financial data) represents a small percentage of total transactions (the so-called tip-of-the-iceberg theory).[12]

Second, transnational enterprises are the primary sources of supply and a significant part of the demand for technical know-how in international turnover.[13] As a result, a large portion of the flow of technical know-how is carried out within these enterprises (between the parent enterprise and its branches or among the branches themselves). Thus, the course of technical know-how, the level and structure of payments, the transaction conditions and many other variables defining the character of the international market for technology are to a great extent shaped by internal corporate decisions, which deform the structure of the market and change its character. It is not a free market; in large part it is controlled and manipulated according to the changing interests of a small number of enterprises. Thus, in this situation it would be more expedient to talk about a technical know-how market only with regard to that portion in which transactions are executed by independent enterprises.

With these stipulations, for greater convenience and simplification of considerations, one can still speak about the international trade of technical know-how in the sense of a market for this good. Concerning its shape and the fact that it differs quite substantially from markets for other goods, its attributes can be determined by the following:

1. It is closely associated with the market for investment goods and the market for the highly qualified work force. This results from the fact that the granting of licenses in general is a part of a bigger contract (for example, the sale of an entire installation) or that it also carries a concurrent flow of machinery and goods. In turn the startup of licensed production often requires the technical help of the license issuer, consulting services and the training of licensee personnel and the like.

2. It is an indistinct market divided by many institutional barriers (resulting from, among other things, the effects of the system to protect patent rights). As a result, it is highly imperfect and contains many elements of monopoly.

3. As the result of the existence of an owner's technical monopoly of protected technical designs that are especially potent, the bargaining position of a buyer in relation to the seller is much weaker than in the case of other, even the most monopolized, goods.[14]

4. With the seller's monopoly and the buyer's weak bargaining position is also associated the possibility of execution by that first segmentation of the market. As a consequence, the seller can establish in a highly discretionary way the cost of technical know-how, imposing disadvantageous conditions on a buyer for its purchase as well as differentiating it, depending on who is competing for the purchase.

5. The connections that arise between buyer and seller are, in general, of a longer lasting and more multilateral nature than with ordinary exchange transactions. They extend to the production sphere and at times even to research and development activities.

The Socialist Countries

Despite the significant increase in the purchase of licenses since the mid-1970's and the export of licenses on a limited scale, the role of the socialist countries in the international transfer of technology continues to be marginal, not corresponding to the achieved level of development, to the investment of research potentials or even to the index of share in other spheres of international economic relations. However, many authors believe that the participation of the socialist countries in world license trade is significantly less, but the license transactions executed within the framework of CEMA, some of which continues to be carried out on a noncost basis, are not taken into account.[42]

But even if this correction is considered, it should be emphasized that most license trade is carried out with developed capitalist countries.[43] During the 1960-1976 period, the socialist countries purchased about 2,200 licenses in the West (including 300 during the 1960-1965 period, 700 from 1966-1970 and 1,200 from 1971-1976), while exporting about 700 licenses.[44] In mid-1970, the average annual expenditure for this purpose was about $500 million while export revenues were $40 to 50 million.[45] The ratio of the value of licenses exported to those imported was more or less 1:10 to 12, and revenues from the export of licenses covered at most 10 percent of the expenditures for imports from this group of countries.

The USSR is the largest importer of licenses from the West; in the 1960's it transacted about 50 licensing agreements annually and in the 1970's, 100 licensing agreements. Outlays for these purposes amounted to $1,259 million during the 1966-1970 period--that is, an average of $250 million annually--and during the 1971-1975 period, about $300 million annually. Beside the USSR, the main purchasers of licenses from the capitalist countries were Poland, Czechoslovakia and the GDR. The order of the amount of purchases was about the same, but in the case of the GDR, after much effort during the 1960's, the import of licenses fell dramatically during the 1970's. During the 1966-1970 period, the GDR spent $455 million--that is, an average of $90 million annually--to purchase licenses but in the first half of the 1970's the scale of purchases decreased to $10 to $15 million annually.[46]

Table 4. License Turnover with the West for the CEMA Countries during the 1966-1979 Period (in millions of dollars)

1 Kraj	2 1966 Wpływy	3 Wydatki	1970 Wpływy	Wydatki	1977 Wpływy	Wydatki
4 Bułgaria	.	32,5	.	7,0	.	.
5 Czechosłowacja	0.8	3,9	9,2	46,7	16,1	63,5[a]
6 NRD	.	89,0[b]	2,0	15.0[c]	7,5	6,0
7 Polska	0,03	6,3	0,2	50,0	4,5	17,4
8 Rumunia	.	74,8[b]	.	.	.	.
9 Węgry	0,2[c]	0,9[d]	0,4	1.5	16,2[a]	47,6[a]
10 ZSRR	.	252,9[b]	.	300,0	.	300,0

11 a — 1976 r.
12 b — średnia roczna dla 5 lat
13 c — 1971 r.
14 d — 1968 r.
15 Źródło: Statystyki licencyjne poszczególnych krajów: *Licensing and Leasing. Committee on the Development of Trade*, ECE, Geneva 1976, s. 16; J. Maciejewicz: *Obroty licencyjne (...)*.

Key:
1. Country
2. Revenues
3. Expenditures
4. Bulgaria
5. Czechoslovakia
6. GDR
7. Poland
8. Romania
9. Hungary
10. USSR
11. 1976
12. Annual average for 5 years
13. 1971
14. 1968
15. Sources: Licensing statistics for specific countries; "Licensing and Leasing," Committee on the Development of Trade, ECE, Geneva, 1976, p 16; J. Maciejewicz: "Licensing Turnovers (...).

By the end of the 1960's, Czechoslovakia purchased over 300 licenses; in the 1970's it imported an average of 50 licenses annually. At the same time, however, this country is the largest exporter of licenses in CEMA; up to the mid-1970's about 50 percent of the revenues from this entire grouping went to Czechoslovakia. Lately, Hungary has been achieving a similar level of export licensing. For these countries the ratio of revenues and import expenditures is about 1:4; that is, like some of the developed capitalist countries having the lowest degree of covering imports with income from the export of licenses.

Against this background, Poland's situation is especially unfavorable. During the entire postwar period (up to 1980) 136 licenses were sold abroad for $29.8 million and the ratio of export income to expenditures for license importation was 1:29. Export income did not exceed 4 percent of import expenditures.[47] Poland's share in the world export of licenses in 1976 was 0.06 percent, compared to 1.1 percent for the export of goods and 2.3 percent for industrial production.[48]

For comparison, it should be added that during a period of only 4 years (1979-1973) Czechoslovakia exported more licenses (179--worth $43.1 million) than Poland did during the entire 35-year postwar period.[49] As a result, the deficit in our license trade was over 2.4 billion foreign exchange zlotys (approximately $736 million) during the 1945-1978 period.[50]

The analysis of the trends in the international licensing market formally leads to several conclusions regarding the factors determining the position occupied by the socialist countries, especially Poland, in the international transfer of technical know-how. The question also arises: In view of overall world phenomena, what are the possibilities of improving this position?

A cursory observation shows that in the case of the socialist countries the factors determining the volume and structure of its license trade are different from those in the rest of the world market. Above all, because of the marginal significance of direct foreign investments in the development of these countries, the flow of production capital has not been a factor to date in initiating license transactions and shaping the intensity of the flow of license imports and exports.

Also, the linkage between license imports and exports of license-derived goods is, for many reasons, very weak. Some of the indexes concerning Poland illustrate this. The importation of licenses to Poland stiumlated export expansion only to a small extent; the tempo of growth of license export was lower than the dynamics of license production. As a result, the share of export in license production decreased from 43.8 percent in 1972 to 25 percent in 1978; the share of license export in total export was very low and in practice did not change during this time (6.2 percent in 1973 and 6.0 percent in 1978).[51] The lack of correlation between the import of licenses and the export of goods can also be traced to the negative balance in license exchanges in the 1970's (the full cost of importing licenses significantly increases income from the export of licensed products).[52]

In light of the experiences to date of the socialist countries, which show--with few exceptions--that the disproportions in the level of exports and imports of technical know-how are of a permanent, structural nature, it appears that the separate treatment of the causes explaining the relative "ease" of importing licenses and the limited volume of its export is justified.

In searching for these causes, it should be emphasized above all that the level-of-economic-development factor--a basic and universally acknowledged determinant of a country's position in the international transfer of technical know-how--does not represent for the socialist countries an adequate explanation of the causes of its great demand for the import of licenses or its inconsiderable capability to export licenses. This is attested to by the fact that many countries with market economies and an advanced level of development showed over a period of years greater demand for import of licenses as well as a capability for exporting them (Spain or Italy). Also, several Third-World countries (Brazil, Mexico and Argentina) imported much more technical know-how than the socialist countries (excluding the USSR).

Experience shows that in the socialist countries demand for the importation of technical know-how is above all a function of the centrally fixed level and structure of investments. At times it also is reinforced by the ease of access to foreign sources of financing development (for example, Poland during the 1971-1975 period). This demand can often be explained by the competition of economic organizations in the realm of unremunerative factors of production

(especially investments and foreign exchange funds) typical for a command-distribution system of economic management. In this formulation, the submitted license inferences are not so much a reflection of actual need as they are above all an additional tool in the competitive battle permitting access to the central investment pool and overcoming recognized foreign exchange limits.[53]

The main cause of the small volume of exports of technical know-how from the socialist countries is the limited capacity of the economy to innovate, which in turn results from the improper system of functioning of the economy (except Yugoslavia and Hungary after 1968) that is historically shaped and is persistent.

If it is assumed that the present position of the socialist countries in the international market for licenses is in sum a reflection of their limited capability to create, use and disseminate technical innovations throughout the entire economy, which is an indication of the inefficiency of the existing system of economic management, then the answer to the question posed earlier about improving the position of the socialist countries (including Poland) as objects of international transfer of technical know-how is quite clear (even though the conclusions derived from it are not at all easy to realize).

Such an opportunity is being provided by the widely conceived, integrated economic reform that will improve the overall efficiency of the socialist economy. One of the main results of the reform should be to increase the capability of the economy to innovate and to undertake rationally development decisions. The reform should not only consider the inefficiencies and barriers existing within the economy but also take into account the wide scope of experiences of other countries and the trends in the world economy. Among other things, these experiences teach us that a prerequisite for improving Poland's position in the international transfer of technical know-how is, in addition to internal changes, the creation of mechanisms leading to the internationalization of the economy. In other words, the concern here is to create via autonomous enterprises conditions under which they would be interested in undertaking external expansion based on strict economic accounting. Undertaking the import or export of licenses under these conditions would be one form for a more extensive involvement in the international division of labor and opening the economy of the socialist countries from within.

NOTES

1. Among the most frequently mentioned forms of international transfer of technical know-how in the broad sense are 1) direct foreign investment and the undertaking of joint production and production-commercial ventures; 2) the sale of machinery and equipment; 3) the export of complete industrial installations (for example, the sale of so-called turnkey installations); 4) production as well as research and development cooperation; 5) licensing agreements; 6) provision of technical services; 7) the "export" of specialists; 8) the training of technical cadres; 9) the exchange of publications and the sale of technical documentation; and 10) the participation in international scientific conferences, meetings and symposia of a general and specialized nature. For example, see "Guidelines for the Study of the Transfer of Technology to Developing Countries," UNCTAD document TD/B/AC.11/9.

2. For example, the export of machinery and equipment as well as complete installations, treated in such a formulation as a form of transfer of technical know-how, is at the same time a component of international trade.

3. As a result of the intensification of the international division of labor, the burden of specialization of production has shifted from the international to the intrabranch level, its present object is to supply parts and subassemblies for final assemblies.

4. For more on the subject of the specific characteristics of technical know-how, see the article by R. Rapacki "The Specific Character of Technical Know-How as a Good," PROBLEMY EKONOMICZNE, No 4, 1981.

5. Regarding the theory linking the international transfer of technology (mainly by transnational corporations) with changes in the consciousness of the people in the receiving countries, see K. Kumar, "A Working Paper on the Social and Cultural Impact of Transnational Enterprises," Honolulu, 1978; J. Cieslik, "The Influence of Transnational Corporations on Changes in Social Consciousness in the Developed Countries," SPRAWY MIEDZYNARODOWE, No 4, 1979; and R. Rapacki, "The Activities of Transnational Corporations and the 'Invisible' Dependence of Latin America," GOSPODARKA PLANOWA, No 3, 1980.

6. C.V. Vallos, "The Process of Commercialization of Technology in the Andean Pact," Lima, 1971.

7. Compare J. Schumpeter: "The Theory of Economic Development," Warsaw, 1960.

8. See L. Nasbeth, G.G. Lee (ed): "The Diffusion of New Industrial Processes on an International Scale," Cambridge, 1974; P.L. Swan, "International Diffusion of an Innovation," THE JOURNAL OF INDUSTRIAL ECONOMICS, Sep 1973.

9. Compare Th. Levitt: "Innovative Immitation," HARVARD BUSINESS REVIEW, Sep-Oct 1966.

10. For the sake of accuracy, international license trade should be broadened to include the exchange of documentation, which, however, often is an inseparable part of license transactions.

11. All license exchanges among the CEMA countries were of such a nature up to 1970.

12. Compare Ch. Cooper, Ch. Freeman and R. Turckean;, "Transfer of Technology," UNCTAD document TD/28.

13. According to some opinions, transnational corporations execute over one-half of the world trade via licenses. See J. Monkiewicz, "Characteristics of the International License Market," SPRAWY MIEDZYNARODOWE, No 4, 1980.

14. For more on the substance of the monopoly of technology and its resulting consequences, see C.V. Voltos, "Transfer of Resources and Preservation of Monopoly Rents," paper presented to Dubrovnik Conference of Harvard, 1970.

42. See J. Monkiewicz, "Characteristics of International Market....

43. For example, of the 624 licenses purchased by Poland during the 1945-1973 period, 42 (or 6.7 percent) were from the socialist countries. During the 1971-1978 period this share was somewhat larger and amounted to 8.8 percent (432 and 38 licenses respectively). The author's own calculations are based on the CIHZ Central License Register.

44. J. Wilczynski, "Licenses in the East-West Transfer of Technology." JOURNAL OF WORLD TRADE LAW, No 2, 1977.

45. J. Wilczynski, "Multinationals and the East-West... pp 70, 75.

46. Compare J. Maciejewicz, "License Trade between CEMA and the West," RYNKI ZAGRANICZNE, No 138, 1980.

47. See R. Rapacki: "Poland's Export of Licenses," ZYCIE GOSPODARCZE, No 21, 1980.

48. Author's calculations and ROCZNIK STATYSTYCZNY 1980, Warsaw, 1980.

49. "Licensing and Leasing," Committee on the Development of Trade, ECE, Geneva, p 16.

50. Author's calculations based on Main Office for Statistics [GUS] data.

51. The index of the share of total export does not take into account the exportation of terminated licenses; If it were taken into account, the index would be somewhat higher; for example, it would have been 7.6 percent for 1978.

52. During the 1973-1978 period, costs for license payments as well as for supply, cooperative and investment imports for licensed production greatly exceeded income from the export of licensed production in totc as well as in relations with the developed capitalist countries. The extent to which expenditures were covered by income for the specified years was respectively: 107.0 percent, 88.1 percent, 70.0 percent, 55.0 percent, 65.6 percent and 99.2 percent; relative to the capitalist countries it was 46.6 percent, 43.6 percent, 37.9 percent, 37.6 percent, 39.1 percent and 54.9 percent. Author's own calculations are based on GUS data.

53. Compare R. Rapacki, "Factors Designating the Demand for Foreign Technology in a Socialist Economy," GOSPODARKA PLANOWA, No 6, 1980.

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CEMA MACHINE TRANSLATION SUCCESSES OUTLINED

Prague ZEMEDELSKE NOVINY in Czech 17 Feb 82 pp 1, 4

[Article by Jan Subert: "Machine as a Translator--Charles' University Coordinates Research by CEMA Countries"]

> [Text] Specialists studying information problems point out that of the deluge of scientific and technical studies, reports and treaties flooding the contemporary world almost one-half can be "written off" as they will never be read by anyone. No wonder. If the first periodical for scientists was published 300 years ago, today there appear more than 3 million discourses annually in the field of natural sciences alone. And, if we take into account the language barriers, we stand face to face with the risk of an "informational collapse" which could become a serious impediment continued social development. The possibilities for averting this threat are several, among them the technique of automated machine translation. In some advanced countries these systems are already at work and, as we found out, even we are not lagging far behind.

Everybody who in his work needs to know what is happening in his field worldwide is very much aware of it. One or two languages can be handled fairly easily, in a third one we do a lot of guesswork and for a fourth and fifth one we must look hard to find somebody to translate the interesting text. And that is precisely the moment when the thought occurs to us: we orbit through space, smash atoms, but to have somebody invent an electronic translator is one thing we have not managed to accomplish as yet.

Wrong! Almost 30 years have passed since the birth of the first translator not made of flesh, blood and bones!

It all happened at the moment when automatic computers made their appearance on the technological horizon. Their memory, combinational capabilities and great speed of "thinking" left no doubt in the mind of some experts that for the first time in history we have at our disposal a means which could effectively cope with the Babel of tongues of our world. And starting with 1954, the U.S. and USSR began to implement for first experiments.

"Of course, the initial experiments were limited to mere translation of one word after another, without any substantial grammatical analysis. However, many researches soon realized that programs for machine translation must be based on a linguistic processing system. Among the pioneering studies in 'grammatical' translation belongs, e.g., the experiments of Soviet scientists led by O S Kulagina, who even at the outset of the sixties conducted verification studies with translation of French into Russian."

These words were the start of our recent meeting with docent Petr Sgall, PhD, DrSc, who heads a team of linguists dealing with the problems of machine translation at the School of Mathematics and Physics of the Charles University in Prague. For example, very few people know that the first successful attempt took place in Prague as early as 1960 with the use of the Czechoslovak SAPO computer which translated English text into Czech. And it is also relatively little known that Docent Sgall's team recently experimentally tested a system that in time will be used by one of our industrial research organizations.

Docent Sgall: "An alert reader is sure to wonder about the 20-year gap between the successful attempt of 1960 and the current--relatively very late--preparations for practical application. It must be said that it was caused by the worldwide skeptical attitude that started to surround machine translation in the early sixties. First of all it turned out that the computer programs compiled on the basis of linguistic analyses would be too complex to be adequately handled by the operational speeds of the then contemporary computers. Pessimism was reinforced also by the pronouncements of some logicians pointing out that the structure of individual elements of language has not yet received adequate scientific description in linguistics. The conclusion was a statement that it is more realistic to improve teaching of languages than to count on the possibility of machine translation. That opinion prevailed for a very long time and we did not return to automated translation until the mid-seventies."

The 11-member team of the School of Mathematics and Physics of the Charles University uses the large Soviet EC 1040 computer which is installed in the building of the university computer center in Prague at Malostransky Square. The complex program prepared for this computer by the mentioned team of linquists, mathematicians, logicians and programmers contains hundreds of grammatical rules and facilitiates reliable machine translation of English texts from the field of electronics.

"Development of machine translation, as a task of the state information policy, is coordinated by the Center of Scientific and Technical Information," explains Docent Sgall and continues. "One of the first to show interest in the results of our efforts was the Research Institute of the Sigma plant in Olomouc, specializing in the field of pumps. According to the agreement which we are negotiating with the institute, Sigma will first implement a translation search system--on the basis of a requirement written in Czech the computer will provide a response referring to relevant literature written in English."

Among the several countries where machine translation is already in use, the leading position is held--thanks to its bilingual status--by Canada. For instance, since 1976 there has been in operation a system translating from English to French all reports of the Canadian meteorological service. It operates at a speed of 1,000 words per minute.

In the Soviet Union there is in operation a system based on an extensive statistical processing of the text and simple grammatical rules; several grammatically very well-thought-out systems are in preparation.

A high-quality system translating from Russian and English has been operating at the university of Grenoble in France and it is interesting to note that so far it has translated over 1 million words from Russian.

As we were further informed, automated translation of foreign-language texts is the subject of joint research by CEMA countries. An important position in that program is held by, e.g., the Laboratory of Machine Translation at the Moscow State Pedagogical Institute of Foreign Languages headed by Professor Rozentsveyg, a department of the Central Institute of Linguistics in Berlin headed by Professor Kunz and other workshops in Moscow, Novosibirsk, Leipzig, Warsaw and Sofia. And it is no mere accident that this entire research is coordinated by Charles University.

Docent Sgall: "We are convinced that machine translation will make it possible for researchers and designers to orientate themselves rapidly and easily in the linguistic maze of the current worldwide information explosion. At the same time, it will provide a solution to the shortage of qualified translators of technical literature. It will not be long before machine translations are cheapter than traditional translations. It can also be expected that further improved automated systems will also find application in published texts and reports."

Experts at the School of Mathematics and Physics in Prague, who in the framework of the Chair of Applied Mathematics introduced to the world the first Czechoslovak system of machine translation capable of finding practical application, point out that its wider distribution is for the time being contingent on show of interest by potential users. If it is expressed, it will be possible to prepare a program for translation of German and French texts, too, and expand it to other technical fields. And that certainly is an offer which our institutes and research centers should not ponder over for long.

8204
CSO: 2402/32

NEW ECONOMIC UNIT TO BOOST FARM EQUIPMENT PRODUCTION

Prague SVET HOSPODARSTVI in Czech 12 Jan 82 p 3

[Article: "Organizational Changes in Agricultural Machinery Production"]

> [Text] A new economic production unit [VHJ] for agricultural machinery production with the designation Agrozet Brno was established as of 1 January 1982 under the jurisdiction of the Federal Ministry of Machine Building on the basis of the resolution of the Presidium of CSSR Government regarding reinforcement of the technological base of agricultural machinery production of 22 October 1981.

The basis of the new VHJ Agrozet Brno is formed by the present VHJ Munitions Plant Brno expanded by incorporation of additional production capacities. The latter include primarily the Roudnice Machine Building Plant and Foundry in Roudnice on the Elbe River, the VHJ Czechoslovak Automobile Works in Prague and the Agra plant in Rozmital of the Nonferrous Metal Ore Mines national enterprise [n.p.] in Pribram. Transferred from under the jurisdiction of the SSR Ministry of Agriculture and Food is the Velke Mezirici branch of the Machine Building Plant n.p. of the Procurement Enterprises in Bratislava, from under the jurisdiction of the CSR Ministry of Agriculture and Food are the Agricultural Machinery Repair Shops [OZS] of the OZS n.p. in Dasice, the Machine Tractor Station [STS] in Roudnice on the Elbe River, the STS Center in Jicin of the STS n.p. in Horice and the STS Center in Kamenice on the Lipa River of the STS n.p. in Pacov. The designation general management of the Munitions Plant is changed to Agrozet Brno, general management.

Establishment of the new VHJ for agricultural machinery production will create the prerequisites for improved meeting of the demands of Czechoslovak agriculture and of foreign trade for agricultural equipment.

The production base of the new VHJ for agricultural machinery production will expand by approximately 3,000 personnel. A substantial part of the latter are already active in production of farm equipment--be it final products or cooperative deliveries for agricultural machinery plants. However, in the

key new organizations--the Roudnice Machine Building Plant and Foundry n.p. in Roudnice on the Elbe River and the plant in Rozmital--a considerable part of production capacities is taken up by other production programs that will gradually have to be turned over to other manufacturers.

The new capacities will contribute by orientation of their production programs toward meeting the pressing needs of Czechoslovak agriculture by the requisite equipment, and by stepping up its production will create the prerequisites for increased intensification of agricultural production in the CSSR. In keeping with the resolutions of the 16th Congress and the Fourth Plenum of the CPCZ Central Committee of October 1981, it was decided to use the newly obtained capacities primarily for stepping up the production and deliveries of machinery and equipment for soil cultivation and sowing, for production of bulk fodders, to include machinery for mechanization of fodder grass processing in foothill areas of mountains, for mechanization of horned cattle keeping and, partially, also for providing small keepers and breeders with the necessary equipment. This end is also served by the organizational structure of the newly obtained capacities and the concept of their utilization:

Operations of the STS in Roudnice on the Elbe River will be incorporated into those of the Roudnice Machine Building Plant and Foundry n.p. in Roudnice on the Elbe River. The plant will step up its ongoing production program for machinery used in soil cultivation and sowing of grain and cereals. Substantial increases in their production will call for, among other things, transfer of the plant's nonagricultural production programs as well as adaptation and modernization of production areas and equipment after their transfer. A systematic implementation of these goals is expected by 1985 to double production for the agricultural sector in comparison to 1980.

Consistent with the needs of Czechoslovak agriculture, most of the newly acquired capacities are oriented toward production of mechanization means for horned cattle keeping, to include machinery for increased production of bulk fodders.

Incorporation of the Nonferrous Mines plant in Rozmital, the STS Center in Kamenice on the Lipa River and the Velke Mezirici branch of the Machine Building Plant of the Purchasing Enterprises in Bratislava into the Agrostroj n.p. in Pelhrimov will increase the latter's manpower by 23 percent. In addition to the main plant in Pelhrimov, it has seven additional branch plants and workshops. This capacity will be used for production of mechanization means for cultivation and harvesting of bulk fodders from arable land and pastures, including those in foothill and mountain regions. For supplanting the production lines of dairy farms, the plant continues its production of milking lines, milking equipment and other specialized products and also continues its production of the sought-after stable manure spreaders.

Incorporation of the OZS plant in Jirikov will also reinforce the production base of the Agra n.p. in Prelouc which is a supplier of complete technological systems for the development and modernization of horned cattle keeping. This includes primarily deliveries of systems for keeping of calves, fattening of

steers and modernization, or eventual new construction, of farms for milch cows. Agra will also use the acquired capacities for the required production of standardized haylage facilities and solar collectors.

Agrostroj in Jicin is a plant specializing primarily in the production of operational systems for cultivation and harvesting of sugar beets, but its production program also includes so-called small-scale mechanization equipment--MF motorized harvesting machines and Terra small tractors which are needed, among other uses, for intensification of agricultural production by small keepers and breeders. Incorporation of the STS Center in Jicin into Agrostroj Jicin will also improve conditions for the development of both of these machine building sectors. To boost the production of the equally needed small tractors, Agrostroj Prostejov is building a branch in Roznava.

Expansion of the production base of agricultural machinery production in the new VHJ Agrozet Brno also brings about improved conditions for utilization of its research and development base and for faster implementation of research and development findings.

Thus, since the beginning of 1982 the new VHJ Agrozet Brno includes a total of 15 organizations, 10 of them production plants--Zetor Brno, Precision Machinery Uhersky Brod, Agrostroj in Prostejov, Pelhrimov and Jicin, the Roudnice Machine Building Plant and Foundry in Roudnice on the Elbe River, Letostroj Letovice, the Humpolec Machine Building Plant in Humpolec, Brnosmalt Brno and Mars Svratka--and five specialized organizations: the Research Institute for Agricultural Machinery in Prague-Chodov (the Research Institute for Tractors is organizationally incorporated into the Zetor Brno n.p.), the Central Enterprise for Agricultural Technology Brno, Agrotechnika Zvolen, Agra Prelouc and the newly established Agrotes Brno agricultural services enterprise.

The VHJ Agrozet Brno with its production plants and specialized organizations is the largest, but not the only, producer of agricultural equipment in the CSSR. Mechanization means for agriculture are also produced by the VHJ Heavy Machinery Plant in Martin, VHJ Czech Automobile Plant Prague, VHJ Chepos Brno, VHJ Sigma Olomouc, the Vitkovice concern enterprise, the Ironworks and Metallurgical Plant of Klement Gottwald and other smaller manufacturers. Agricultural equipment costing in excess of Kcs 12 billion (machinery and equipment for production of produce, fruit, wine, needed equipment from small-series production, etc) is to be produced for the CSSR in the course of the Seventh Five-Year Plan also by the VHJ STS and OZS in Vinor and in Rovinka and other agricultural organizations and other sectors not engaged in machine building.

Further intensification of Czechoslovak agriculture and improved providing for its needs will be also promoted by implementation of the program for the direly needed redesign and modernization of the extant production capacities of the former Munitions Plant VHJ. The program is linked to the development of new agricultural means of mechanization which will be introduced into serial production at the conclusion of the current and the beginning of the new five-year plan in keeping with the Czechoslovak system of agricultural

equipment in accordance to the needs of international cooperation of CEMA countries as well as Czechoslovak foreign trade.

As has been emphasized in the report of the Presidium of the CPCZ Central Committee, read at the Fourth Plenum of CPCZ Central Committee by Comrade Pitra, secretary of the CPCZ Central Committee, the essential prerequisite for gradual solution of problems in mechanization of our agriculture is close collaboration and cooperation of the new agricultural machinery VHJ with agricultural enterprises, STS and other plants in the machine building sector. An agreement regarding a long-term program of cooperation designed to provide for the Czechoslovak system of agricultural means of mechanization, deliveries of complete mechanized lines, further expansion of recycling of spare parts and increasing their share of production has already been negotiated with both VHJ STS and OZS (OPS) in Vinor and in Rovinka.
The agricultural machinery VHJ also cooperates closely with its partners in agriculture on introduction of a new system for delivery of replacement parts, being checked out in the Vyskov and Nitra districts, and in other areas of mutual relations among producers, suppliers and users of agricultural equipment. The decisive prerequisite for introduction of this system is renewal, combined with expanding the capacity of the computer system of the marketing network of the new Agrozet VHJ by the EC 1055 system in 1983.

The report of the presidium of the CPCZ Central Committee at its Fourth Plenum also contains the requirement for gradual development and expansion of the production base of the new agricultural machinery VHJ. From this viewpoint, the accomplished transfer of seven organizations and organizational units into the new Agrozet Brno VHJ represents a decisive step toward dealing with the former dissipation of efforts in the production base for agricultural machinery in the CSSR.

8204
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INTERFERON RESEARCH, PRODUCTION PROGRESSING

Budapest MAGYAR HIRLAP in Hungarian 27 Feb 82 [supplement p 8]

[Excerpts] Hungarian interferon research began officially in 1963 at Szeged Medical University. By 1974, research findings were described in the literature by Mrs Bela Olah, professor, head of the Szeged university team working in this field.

Research is also in progress in the Soviet Union and Yugoslavia. For the past 2 years Yugoslavia has been producing the equivalent of 60 percent of Finnish output and using it on patients in the form of suppositories and ointments. In these forms less of the active ingredient is required.

The high cost of interferon was drastically reduced in 1980 when Charles Weissmann of Zurich succeeded in preparing human interferon through genetic engineering. When made with use of bacterial cultures, interferon yields are as high as 1 milligram per 1 liter of culture.

Production of interferon is finally about to begin in Hungary. EGYT [United Pharmaceutical and Nutriment Factory] took note of the continuing experimentation at Szeged. However, the white blood cells received from the university blood donor center were insufficient for satisfying demand in excess of laboratory use. Now EGYT is establishing an association for promoting interferon research and production with the Institute of Microbiology of Szeged University and the National Institute of Haematology and Blood Transfusion. According to Istvan Bihari, executive director of EGYT, the factory's 200 million [forint?] investment is only a few weeks behind schedule, and the installations purchased from the West will become operational in March of this year. It is estimated that 400 billion units of interferon will be prepared. One ampoule contains 1 million units. Although the initial product will not be entirely pure, experimentation is expected to improve purity by the second half year making the product suitable for clinical testing.

This year only alfa interferon will be made, but next year the gamma type will also be prepared. The product will be exported to American and West European firms which have made inquiries. Although valid contracts do not exist yet, the goal is to export interferon worth several million dollars in 1983-1984. As soon as clinical testing is approved, certain Hungarian institutes will also be supplied with the quantities required.

Possibility for producing interferon through genetic engineering exists at the Biological Center in Szeged where this technique has a tradition of several years and has produced notable results. So far the small group working there has been unable to consider interferon production through genetic engineering for lack of financial support. At present they are using the technique to produce insulin.

CSO: 2502/54

BRIEFS

MICROPROCESSOR CONFERENCE--A two-day conference on domestic use of microprocessors and PLCs [programable logic controls] has been convened at headquarters of the MTESZ[Federation of Technical and Scientific Associations]. Its purpose is for teachers, researchers, developers, producers and consumers involved with use of up-to-date technology to exchange experiences, report results and debate possibilities for progress. Several speakers have emphasized the importance of special training. Use of microprocessors and PLCs has been taught for only a few years at institutions of technical education. At present special courses are being offered at Budapest Technical University within the framework of the continuing education program in engineering. Furthermore, 15 industrial enterprises have recently established a joint applications technology service. They stressed that although Hungary is expanding production of apparatus involving microprocessors, the technology should be adopted throughout industry as soon as possible. [Budapest MAGYAR NEMZET in Hungarian 2 Mar 82 p 3]

CSO: 2502/55

1/f NOISE OF RESISTORS WITH GRAINY STRUCTURE

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 20 No 11, Nov 81 pp 321-322

AMBROZY, ANDRAS, Dr, professor, department of Electronic Technology, BME [Budapest Technical University]

[Abstract] The 1/f noise (where f denotes the test frequency) of thick-layer resistors (the presently most often encountered resistors with grainy structure) was investigated theoretically with the aid of mathematical models in a number of publications. The author summarizes these publications. The effect of current fluctuations is relatively easy to explain. It is caused by fluctuations of conductivity. However, no really satisfactory explanation has been developed for the frequency dependence, which is evident over the entire frequency range, even at frequencies of one millionth of a Hz. According to recent views, the noise output in thick-layer resistors is directly proportional to the square of the DC current flowing through the device and inversely proportional to the resistivity. Various structural models were proposed for specific resistors, for example solid-state barium(strontium) titanate. Figures 2, references 10: 2 German, 1 Hungarian, and 7 Western.

2542
CSO: 2502/44

DESIGNING AND MASK PROGRAMMING OF EIGHT KILOBYTE MASK-PROGRAMMED ROM'S

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 10, 1981 pp 365-368

ASZTALOS, ANDRAS, graduate electrical engineer, scientific group leader, and FARKAS, GABOR, Dr, graduate electrical engineer, staff scientist, Research Institute of the Communications Technology Industry

[Abstract] In the paper delivered at the 17 September 1980 TKI [Telecommunication Research Institute] Youth Conference, the authors discussed the designing and mask-programming of 8-kbyte mask-programmed ROM's [read-only memories] featuring n-channel, silicon control-electrode MOS technology, where the threshold potential difference of the transistors is achieved with the aid of a block-direction voltage connected between the source and the bulk electrodes. The data required for circuit design are obtained from the specification sheets of the devices and by measurements. In the example discussed, circuits of Intel Type 2308/8308 were employed. These data are then processed to obtain the block diagram, the logical connections, the electrical circuitry (using the cells available and sequential analyses), and the layout design. This can be carried out with the ANAL 20 program of the TKI AUTER system. Such procedures are currently used in actual practice for preparing the memory pattern of the control tapes of the ICOMAT-2 measuring automaton and the ICOMAT-110. The computer-aided procedures are illustrated with block diagrams and flow charts. Figures 5.

2542
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METHODS FOR MEASURING THE RELIABILITY OF INTEGRATED CIRCUITS AND COMPUTER-AIDED EVALUATION OF THE RESULTS OF THE MEASUREMENTS

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 10, 1981, pp 361-364

DROTOS, LASZLO, graduate electrical engineer, staff scientist, and VARADI, ISTVAN, graduate electrical engineer, scientific group leader, HIKI [Research Institute of the Communications Technology Industry]

[Abstract] In their paper delivered at the 17 September 1980 TKI [Telecommunication Research Institute] Youth Conference, the authors described the reliability-measuring methods used for integrated circuits, the use of computers to assist in these measurements, and the evaluation of their results, and illustrate the theoretical discussion with two examples involving the reliability testing of two TTL MSI integrated circuit types. The two integrated circuits are of Texas Types SN74142N and SN74191N. The computer processing of the tests (involving high-temperature storage, electrical load-resistance testing, performance under static and dynamic loads, etc.) involves compression and transfer of the data obtained on punched tape to magnetic tape, updating and correcting of the data, statistical processing of the corrected data, and derivation of the reliability characteristics. A flow chart illustrates the procedures used. The results of the tests performed are presented in tabular form, to illustrate the information that can be obtained by means of the procedures described. Tables 3, figures 2, references 3: 1 Hungarian and 2 Western.

2542
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ELECTRONICS AND ELECTRICAL ENGINEERING HUNGARY

THE LINE OF INTELLIGENT VIDEO TERMINALS FROM THE VIDEOTON ENTERPRISE

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 10, 1981 pp 376-380

HADREVI, ISTVAN, graduate electrical engineer, Videoton

[Abstract] A brief description is given of the intelligent video terminals manufactured by Videoton. The VDDS (Videoton Data Display Station) family features circuitry of high integration and a bus system, with the connectors formed directly on the NYAK boards, resulting in a significant reduction of internal connections and connectors required. Synchronous version, asynchronous version, and asynchronous version with cassette are available. The individual models are versatile, expansible, and can display any alphanumeric character, and special graphic and line diagrams. Microprogrammed text editing, data transmission, periphery handling, and the like make these terminals suitable for a wide variety of uses. When operated in the enquiry mode, they permit the operator ready access to the files of the central processor. When operated in the data-entry mode, they replace conventional card-punching equipment, and can be used for file actualization and on-line data recording. The VT-20 system, developed from the basic VDDS family, has added memory capacity, screen controller, alphanumeric keyboard, INTEL 8080A micrprocessor, 64 kbyte memory, matrix or line printer, asynchronous or synchronous data path and a VT-20 software system (operating system, source-text editor, assembler, dynamic data-base handler, BASIC interpreter, and test programs). The VDT alphanumeric video terminal family is designed to be an operator-central processor interface in computer systems. The terminals are of modular design, comprising the following autonomous components: display with monitor, keyboard, and line interfaces. The SZM 7219 and the VSD 47703 terminals, described in some detail, are typical members of this family of products.

2542
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THE CONCURRENT PASCAL PROGRAMMING LANGUAGE AND ITS POSSIBLE APPLICATIONS

Budapest INFORMACIO ELEKTRONIA in Hungarian Vol 16 No 6, 1981 pp 309-318
manuscript received 17 Jul 81

KACSUK, PETER, and GROF, JOZSEF, Videoton Development Institute

[Abstract] This article describes the high-level programming language, called Concurrent Pascal, for the designing of operating systems. The original Pascal language supports only the writing of sequential programs. The Concurrent Pascal -- a modification of Pascal, making it suitable for concurrent programming, developed by Brinch Hansen (IEEE SOFTWARE ENGINEERING, June 1975 pp 199-207) -- contains means for writing concurrent programs. It uses the data types, variables, and commands of Pascal but allows concurrent programming by introduction of means for handling cooperating and(or) competing processes. The primany features of Concurrent Pascal are assignment of the variables bebelonging to the individual processes, and a translator program checking whether these so-called private variables indeed reach the assigned process, and only that process. The Concurrent Pascal separates the cooperating sequential processes in a structured manner; is structured of access privileges, private data fields, and sequential program; ensures that only the declarative process reaches the data structure; and has an active operating mechanism. The original Concurrent Pascal was realized on a PDP11/45 computer. The practical use of Concurrent Pascal is illustraded by an example involving an airline seat-reservation system. It is recommended that Hungarian microcomputer developers and users make increased use of Concurrent Pascal to benefit from its compactness, modularity, and easy documentability. Figures 3, tables 2, references 11: 1 German and 10 Western.

2542
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COMPUTER-AIDED DESIGNING OF THICK-LAYER HYBRID INTEGRATED CIRCUITS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 20 No 11, Nov 81 pp 334-340

KIESNAST, WOLDEMAR, Dr, professor, scientific department head, and BURKHARDT, WINFRID, Dr, staff scientist, Institute of Information Science and Theoretical Electrical Sciences, Technical University, Ilmenau, GDR; RIPKA, GABOR, Dr, associate professor, and Mrs RECZEY, GUSZTAV, assistant professor, Department of Electronic Technology, BME [Budapest Technical University]

[Abstract] The program system developed at Ilmenau Technical University for computer-aided designing of thick-layer hybrid integrated circuits is described and illustrated with flowcharts, graphs, diagrams, and drawings. The article also describes a program system developed for the same purpose at BME, the documentation obtained, and the actual manufacture. The GDR system uses an ODRA 1204 computer and a Type I ADMAP digital drawing device; the Hungarian system uses a HP 9810 benchtop calculator. The designing of the integrated components and the entries in the hybrid-device data bank, manual design of the topology, the completion of data forms, the preparation of data tapes, the entry of the topological data in the cassette, the methods used to improve or redesign the circuitry, and the documentation obtained are described. Both program systems significantly reduce the designing time, minimize manual work, and produce a punched tape that can be directly used for the preparation of enlarged drawings. Additional program routines (data-tape read-in program with the aid of which the topological drawing can be transferred directly to the drawing digitalizer, and a program for preparing a control tape for the Soviet-made EM 549 pattern generator) were also developed.
Figures 8, references 7: 5 German, 1 Hungarian, and 1 Western.

2542
CSO: 2502/44

COMPUTER-AIDED DESIGNING, MANUFACTURING, AND CHECKING SYSTEM (TGE) OF PRINTED CIRCUITS AND SUBSYSTEMS ASSEMBLED FROM THEM IN THE TELEPHONE FACTORY (PART I)

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 10, 1981 pp 381-386

KOVACS, ANTAL, graduate mechanical engineer, graduate economics engineer, department head; PAL, IMRE, graduate mechanical engineer, graduate economics engineer, group leader; and HORVATH, JANOS, graduate electrical engineer, graduate economics engineer, group leader; TERTA [Telephone Factory], Budapest

[Abstract] This first part of a series of articles describes the goal of the TGE system, which was designed with the following goals in mind: improving product quality; reducing the manufacturing time; reducing the need for qualified staff; standardizing design, parts use, manufacturing technology, and documentation; increasing productivity; improving the competitiveness of the enterprise; and obtaining various other advantages. The designing system, documentation-generating system, circuit designing, manual design assistance and documentation generation, and computer-aided design assistance and documentation generation are briefly described in this part of the series. Among the equipment used are the following: Benson Type 1202 drawing machine and VT line printer, Ferranti Freescan System 4 digitalizer, and Ferranti-Cetec Graphics Ltd. EP 430 drawing machine. The basic units of the software configuration are: DOS-RV operating system, ANAL-24 program packet for AC analysis of linear networks, the ANAL-17 program packet for simulation of digital circuits, the KONSTR-M program packet for layout and wiring of printed circuit boards, the KONSTR-3-F program packet for handling digitalized printer circuits, the TECHN-T program packet for technological processing of printer circuits, and the UNIVIC and UNIVAX programs for generating the data carriers for automatic wiring machines for printed circuits. Flowcharts and photographs are shown to illustrate the operations described. Figures 6.

2542
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LATEST ACHIEVEMENTS IN DISTORTION MEASUREMENT WITHOUT FILTERS

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 12, 1981 pp 452-455

KOVACS, PAL, graduate electrical engineer, Institute of Communications-Technology Electronics, BME [Budapest Technical University]

[Abstract] Theoretical and experimental studies were carried out to realize an automatic distortion-measuring instrument of high resolution, which derives the harmonic distortion factors required in practice from the amplitude distribution values of the output signal of the system without the use of filters. The mathematical foundation of the principle employed is based on the nonlinear transformation of the amplitude distribution functions. Some simplifying conditions were introduced and means for selecting the test points were developed. The studies also covered the relationship between the amplitude distribution parameters and the harmonic distortion factors, and the resolution and measuring time. The block diagram of the realized instrument was presented. The equipment may be used for sinusoidal or Gaussian signal distribution. The Research Institute of the Postal Service commissioned the assembly of an operating instrument for measuring the distortion of a signal having Gaussian amplitude distribution (the signal to be tested at a resolution of 0.1 percent is in the 20 Hz to 20 kHz range). A version of this instrument for measuring the distortion of a signal having sinusoidal amplitude distribution is under preparation. Figures 4, references 4: 3 Hungarian and 1 German.

2542
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PROGRAMMING OF CONCURRENT SYSTEMS

Budapest INFORMACIO ELEKTRONIKA in Hungarian Vol 16 No 6, 1981 pp 304-308
manuscript received 18 Nov 80

NACSA, SANDOR, department head, SZAMOK [Computer Technology Educational Center]

[Abstract] The author surveys the special problems encountered in the programming of systems of the concurrent principle, and discusses briefly the means available for generating and using the problem-solving algorithms. Concurrent programming -- which has now become a reality as a result of explosive growth of hardware speed -- has many obvious advantages over consecutive programming. The goal is to organize the various asynchronous components which cooperate and(or) compete. Insofar as the algorithm is concerned, the system made up of asynchronous components is characterized by paralleleity and nondeterminism, The literature of concurrent programming is mostly recent and sparse. The goal of the article is to summarize this literature to acquaint the reader with current thoughts in this field. The following subjects are discussed: development of concurrent systems, theoretical problems of concurrent programming (definition of the process, relationships among processes, concept and role of the power source, coordinational problem categories, hazards emerging in the course of coordination), and devices supporting concurrent programming (synchronizing and coordinating devices) and their development. Special languages (such as CSP, Distributed Process, and ADA) were developed to deal with the problems involved. References 13 Western.

2542
CSO: 2502/43

TYPE BK-300/N 300-CHANNEL CARRIER-FREQUENCY SYSTEM FOR SYMMETRICAL CABLE TRANSMISSION LINES

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 12, 1981 pp 461-468

PORPACZY, ELEMER, graduate electrical engineer, design engineer, TERTA [Telephone Factory]

[Abstract] The BK-300/N system can transmit 300 telephone channels over four-wire, separate-frequency, cables. The strand diameter is 0.9 mm Cu, 38.5 nF/km, the transmission is of the two-wire type. The multiplex systems up to the primary group are those conventionally used in systems with more (up to 2700) channels. The line frequency band of the system has five primary groups from the 312-1548 kHz band. The line section devices are of three main types: KEK-300/N combined amplifier frame, NBK-300/N remotely powered,remotely monitored amplifier, and auxiliary devices (portable power supply and telephone, and crosstalk-attenuating coil). There are two types of terminal, differing in the frequency range they handle. Remote supply is via the phantom circuitry of carrier-frequency circuits. The nominal distance between the amplifier stations is 1830 m. The system is protected against overvoltage and high-voltage interference. The devices of the terminal and the supervisory central station are supplied from the AC network or a central DC supply. The remotely supplied amplifiers are housed in corrosion-reststant steel casings. The major subassemblies (terminal (KEK-300/N), line termination module (VVB-300/N), line-transformer module (VTB), fault localizer module (HB-4), the service module (SB-3), remote-supply module (TTE-300/N), and remotely supplied and remotely monitored amplifier (NBK-300/N)) are described. The system and the devices are illustrated with circuit diagrams and specification charts. Figures 10.

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TECHNOLOGICAL ASPECTS OF DESIGNING MULTILAYER PRINTED CIRCUITS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 20 No 11, Nov 81 pp 330-333

TOTH, ENDRE, associate professor, Department of Electronic Technology, BME [Budapest Technical University]

[Abstract] The factors to be considered for achieving the primary requirements imposed on multilayer printed circuits are briefly discussed. In large-scale manufacture, the dimensional accuracy and stability of the film is highly important. Another important factor is the accuracy and stability of the laminations relative to each other. The means to achieve these goals depends on the composition of the substrates and on whether drilled holes are provided on the circuit board. The manufacturing steps of a four-layer printed circuit board without drilled holes, including a copper layer, was described to illustrate the considerations involved. Difficulties can arise in the galvanization process from the fact that the current-density distribution is not uniform (for example, in some individual, thin conductor paths the current density is likely to be much over the average). To some extent this can be compensated by proper designing of the printed circuit. Heat sinks and cold joints must be scupulously avoided. Most of the factors required to eliminate these hazards must be considered when preparing the circuit documentation which comprises the technological parameters of the materials used, the configuration of the circuit, and the properties of the substrate. Figures 9, referemces 2: 1 Hungarian and 1 Western.

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No. 739

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EAST EUROPE REPORT

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BULGARIAN-SOVIET OCEAN EXPEDITION COMPLETED

AU241215 Sofia RABOTNICHESKO DELO in Bulgarian 23 Mar 82 pp 1, 4

[RABOTNICHESKO DELO correspondent's report from Varna on successful completion of the Soviet-Bulgarian ocean expedition, and on press conference held on 22 March on board the Soviet explorer ship "Vityaz"]

[Text] Varna, 22 Mar--"Vityaz," the Soviet explorer, has once more docked at Varna. We can admire its beautiful, white hull from far away. For almost as long as 2 months Bulgarian and Soviet experts jointly accomplished difficult research tasks and expeditions, diving at great depth in the vicinity of Cyprus and in the area surrounding the "Ampere" underwater mountain in the eastern part of the Atlantic Ocean. A press conference for numerous jornalists was held on board the "Vityaz" explorer ship today, on the occasion of the successful accomplishment of the expedition.

Prof Vyacheslav Yastrebov, doctor of technical sciences, deputy chairman of the Soviet Academy of Sciences' Oceanological Institute, and head of the expedition, described the scientific results and summed up the basic conclusions drawn from the experiments made during the expedition. "We have accomplished our scientific tasks," he stated. "We are satisfied with the work of the Bulgarian experts' team, under the leadership of Eng Nikola Dukov, candidate of technical sciences from the Varna Institute of Maritime Research and Oceanology. New technical methods and equipment for underwater research work have been applied and tested," he added.

The journalists attending the press conference were shown pictures of the "Ampere" underwater mountain, situated in the eastern part of the Atlantic Ocean, made with the underwater towing apparatus called "Sound." The other participants in the expedition also spoke on their impressions about the joint research work accomplished during the expedition.

CSO: 2202/92

BRIEFS

COOPERATION WITH ELORG CITED--Soviet foreign trade enterprise Electronorgtekhnika (ELORG) conducts trade with companies in 30 countries, reaching a yearly turnover of 1.3 billion rubles. Elorg's exports have been increasing approximately 12 percent per year. It exports and imports computer system technology, microcomputers, office organization technology, microcalculators, active and passive electronic components and other products. During the past 10 years, Elorg delivered over 700 computers to Belgium, India, Bulgaria, Czechoslovakia, the GDR, Finland and Cuba. Favorable cooperation with several companies in France, Italy, the FRG, Spain and Greece continues. In Finland, Elorg established a computer center which serves the needs of about 80 industrial producers. Elorg has very close trade relations with producers in socialist countries. Under the agreement on specialization and cooperation in computer technology production in CEMA countries, mutual deliveries of computers will reach more than 15 billion rubles. Czechoslovak foreign trade establishment KOVO is one of the top trade partners of Elorg, exporting to the USSR the Consul electric typewriters, photoelectric equipment for punched tape readers, punching machines, Digigraf drafting tables and other secondary equipment for computer and office technology. Elorg exports to Czechoslovakia at this time third-and-half generation computers ES 1035. In a few years, Elorg will be able to offer to its partners new computer systems such as a joint system of second series of computer technology and microcomputers, a computer system for automated control of large industrial plants and large computer units such as the ES 1043. The ES 1043 has a capacity to process 1.5 million operations per second and the ES 1060 1.3 million. Both of these units have been designed to process a broad spectrum of scientific, technical and economic tasks and a large number of information. They can process data for a consumer 13,500 km distant from the computer, as well as communicate with him by telephone, telegraph or radio. They also have visual memory, a broad system of self-control and a capability to locate defects. A reduced-size ES 1060 unit was exhibited at the 1981 Brno Trade Fair. It had a capacity of 1.2 million operations per second and included the external memory equipment ES 5066, analog computer AVK 31, machine for analog computing unit AVK 32, electronic key computer Iskra 2240, electronic unit OMEGA 111-ZE, as well as other equipment. [Prague JEMNA MECHNIKA A OPTIKA in Czech No 2 1982 p 36]

CSO: 2402/44

IMPROVEMENT, AMPLE USE OF MICROPROCESSOR SYSTEM DESCRIBED

Sofia OTECHESTVEN FRONT in Bulgarian 26 Mar 82 pp 1, 3

[Article by Zakhari Nikolov: "The Microprocessor Becomes Part of Our Daily Life"]

[Text] The collector rings at the door and presents you with a bill that states that you have consumed more than 200 leva worth of electric power.... You look in amazement and then begin to try and disuade her: "This is a mistake! The apartment is heated with steam, the kitchen stove is gas, it is just impossible!..." Another case. In the mail you receive a statement that you must pay a large amount for telephone calls while in recent months there had been no one in the apartment. Many persons who have involuntarily fallen into such a situation would be inclined to accuse the primitiveness of the automatic call recording equipment, the electric meters or even the collectors. There commence complaints, letters and an excessive loss of time and strain on nerves.

Certainly such mistakes do occur rarely but all the same they do happen. And they happen because all the information concerning the electric power consumed by enterprises in the capital city of a million strong is delivered "all in a heap" for processing to a large computer just several days before the start of each month. It takes just a little inattention by the operators in filling out the cards, a wrong number or a transposed comma and...when the computer's "brain" is turned on, the bills are printed so rapidly that it is difficult to see which is right and which is not....

From Silistra has come the news of the serial production of new microprocessor computer systems called the IZOT-0250 at the Office Equipment Combine. At first glance this would seem to be some information which would interest only specialists. But the purpose of these electronic machines is to process very quickly and precisely the bills for electric power, telephone calls and scores of other statements and banking reports.

The initial fears that the old mistakes would reappear have been unfounded. In just several months of operation, the IZOT-0250 microprocessor has shown that it performs the calculations accurately and dependably and it can be relied upon.

In the center of the city where their exhibition hall is located, in addition to the IZOT-0250 microprocessor system, there is also a text-processor [?word processor], an electronic system, a warehouse control computer and so forth. In terms of

appearance the IZOT-0250 is like a small desk with a built-in keyboard, an electronic unit and printer which automatically can print up to 30 letters and figures a second. The operator punches in all the data including the name, the address of the subscriber, the reading of the electric meters or telephone counter. The information is stored on a floppy magnetic disc which is reminiscent of a plastic record. Up to 150 printed pages can be stored on a memory disc and this is the equivalent of the data from 112 subscribers. The most important part of the machine is the microprocessor which is of matchbox size. This sets the instructions for the peripheral units such as the reader, printer and so forth at a speed of up to 500,000 operations a second. Thus, having first made up the operating program for the system, the operator by merely depressing the keys can extract from the memory all that is known about the subscriber, enters the last readings from the readers while the machine itself performs the calculations and very quickly prints out the complete statement. Here mistakes cannot occur because each operator immediately checks whether the amounts entered on the blank are within the normal limits or are in error. This has certainly not always been the case.

First I visited the okrug communications administration in Silistra. In one of the rooms there were three IZOT-0250 machines at work.

The operator Zhelyazka Petrova said: "Previously we had to write out in hand 1,200 slips per day. We could not move from our desks. Now all the work is done by machine. And it is also good that it was very quick and easy for us to learn how to operate it. It took us just 15 days to train for it. And it is impossible to make mistakes. Everything is right in front of your eyes...."

The three machines processed the data for close to 8,000 telephone subscribers in the city and okrug. This means 15 million calls a quarter and they, multiplied by 2 stotinks each, produce 300,000 leva. It seemed unbelievable to me that the chief bookkeeper at the administration Stoyko Ivanov could admit that productivity had risen 30-fold after the introduction of the microprocessor systems. But this is quite natural because in addition to the fact that the documents are prepared very quickly, it becomes possible for the bank each day to receive them processed and immediately calculate the income for the system. In the past these calculations took 1 or 2 months.

As was said by Damyan Dimanov, chief account at the Serdika Dairy in Silistra: "The Orgtekhnika [Office Equipment] microprocessors help us in carrying out the new economic mechanism. Every day we delivery 50,000-60,000 containers of acid milk and fresh milk to 120 stores and points in the city. This alone is enough to gain an idea of how many bills and documents would be scattered about if before each trip the drivers did not submit their waybills for machine processing. Very accurately and quickly they can run a check and know what quantity of cheese they have shipped and how much there is at the warehouse. These figures certainly were kept before, but at a price of the continuous scribbling of scores of workers...."

Like any new equipment loaded almost to the maximum, the IZOT-0250 microprocessor system initially showed certain defects. Some mechanical parts were damaged, the printer jammed, the cables became disconnected and there were even instances of the loss of the recordings on certain magnetic discs.

As was stated by Georgi Dechkov, the chief of the Electronic Data Processing Section under the Sofia Electric Supply Combine: "With such problems we immediately turn to specialists at Orgtekhnika in Silistra. For us it is very important that the machines operate constantly for 16 hours because we process around 420,000 bills a month with a value of 10 million leva. For this reason we must depend on the equipment and we intend to convert completely to using the IZOT-0250. Any problem can be corrected but it seems to me that only the people in Silistra are interested in improving the machines. There are rather many other plants and enterprises that are also involved in manufacturing the microprocessor system...."

Probably the concern of these specialists is a valid one. For this reason every day they watch how the individual assemblies of the machines operate. They have already eliminated weak points in the printer and keyboard, the magnetic discs and the electronic unit. But up to now the representatives from the other enterprises involved in producing the IZOT-0250 have not been heard from. For example, it would be possible to imagine a doubling of the typing speed and this would have to be solved immediately by the designers at the Typewriter Plant in Plovdiv. The same applies to the producers of the magnetic discs, the electronic elements and so forth.

There is one other problem. Are the new machines presently installed in suitable quarters? Unfortunately the situation is the worst at the building of Power Supply in Sofia. There five or six machines have been crowded next to one another in small and inconvenient rooms.

The first months of the IZOT-0250 have been successful. Clearly the money has not been thrown to the winds. But this good beginning must not seem to some also as a good ending.

10272
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BRIEFS

INTERCOSMOS PROGRAM PARTICIPATION NOTED--A group of experts from the Nuclear and Physical Engineering Faculty (under Eng. K. Hamal], Czech Institute of Technology in Prague, has been participating in construction and provicing equipment for an Intercosmos network of 14 laser observatories in Europe, Asia, Africa, South America and Cuba. The CSSR-made laser radar can locate satellites and measure the distance of 10,000 km within a 20-cm margin of error. Equipment for thermal mapping of Earth has been worked on at the Institute of Physics, Charles' University. The Mathematics-Physics Faculty has been successfully involved in the Intercosmos program [project Intershock] for several years. [Prague SVOBODNE SLOVO in Czech 8 Apr 82 p 4]

CSO: 2402/43

ACQUISITION, USE OF MAGNETIC DATA CARRIERS

Budapest SZAMITASTECHNIKA in Hungarian Dec 81, Jan 82

[Article by Laszlo Bagonyi and Peter Cziffra]

[Dec 81, p 6]

[Text] At the moment we are operating seven ESZR [Uniform Computer Technology System] configurations at the EGSZI [Institute of Construction Management and Organization]--as has been reported in a number of articles and in the columns of this journal. In addition to the ESZR machines we have a SIEMENS 4004 and an IBM 370 computer. In the area of data recording, we have one RC 3600 group magnetic data recorder and a number (about 70) individual magnetic tape data recording devices.

Thus in regard to units using magnetic data carriers we have the following equipment in operation:

	Magnetic tape drive units		Magnetic tape drive units	
[as published--probably, "disc drive" intended for the second double column]				
	Type	Number	Type	Number
ESZR	5012-01/03	34	5052	6
	5017	8	5061	51
SIEMENS	4453	6	4581	8
IBM	2311/3410	4	3330/3333	4
RC	3620	2	3652	2
Total		54		71

We use a respectable quantity of magnetic data carriers each year on the above units because without exception our machines are operated on three shifts. Our services are used by more than 100 economic units throughout the country, primarily with the aid of our planning, production-control and enterprise-

management models developed for construction industry and construction materials industry enterprises and planning institutes.

We would like to share our experiences, gathered over a number of years, in connection with magnetic data carriers.

Acquisition of Magnetic Data Carriers

We plan the quantity of magnetic data carriers to be acquired each year by taking into consideration the known data (number of units, number of models run, number of enterprises and operational time); ordering is done in October, up to the end of November, of the year preceding the year in question. The following table shows the quantity of magnetic data carriers acquired by our institute from 1979 to 1981. (Quantities are converted to the 2,400-foot basic type.)

Magnetic Tapes

	BASF	RACAL	SCOTCH	Total (units)
1979	--	2,600	650	3,250
1980	2,069	950	160	3,170 (sic)
1981	1,635	500	380	2,510 (sic)

Magnetic Disk Packs

	2.5 Mbyte cartridge*	7.25 Mbyte	29 Mbyte	56 Mbyte	100 Mbyte	Total (units)
1979	BASF	--	--	--	--	
	CAELUS	56	268	--	--	
	SCOTCH	--	65	--	--	
	Total	56	333	--	--	389
1980	BASF	--	--	25	--	
	CAELUS	20	50	--	--	
	SCOTCH	--	--	--	--	
	Total	20	50	25	--	110
1981	BASF	--	25	5	20	
	CAELUS	--	--	--	--	
	SCOTCH	--	74	-	--	
	Total	--	126	5	20	151

*[as published; the missing values may be calculated from the totals]

In addition to these types, we use or have used MEMOREX and ORWO magnetic tapes and MEMOREX and IZOT magnetic-disk packs. The acquisition sources for data carriers--as is well known--are the NOTO OSZV, MIGERT, VOLAN Elktronika and PIERT enterprises.

In general we order from several suppliers, to be safe if some foreign firm has delivery difficulties--as has happened several times over the years. In the case of magnetic tapes, this is why we gave up the MEMOREX products. We had quality problems with the ORWO tapes. In the case of magnetic-disk packs, we purchased the IZOT disks together with the computer configurations.

Thus, on the basis of the calculated values we buy 2,980 magnetic tapes and 217 magnetic disks per year. The quantity of magnetic tapes can be expected to stabilize at 2,500-2,600 units per year (in the event of an unchanged machine park and task structure). In the case of magnetic-disk packs, the 7.25 Mbyte disks will "run out" after replacement of our ESZ 1020 machines. The number of units of 20 Mbyte disk packs will be about 50-80 per year. Use of the 56 and 100 Mbyte disk packs will not significantly exceed 15 units each per year.

In regard to packaging magnetic tapes, we are emphasizing a closeing-ring solution which makes for better use of storage space. We use boxes only for transportation, because of better mechanical protection properties. In the case of magnetic-disk packs, it was necessary to make claims during the quarantee period. The claims in connection with IZOT and MEMOREX disks were accepted. The number of units was not significant.

To sum up concerning acquisition problems, thus far acquisition or variety difficulties have not interfered with the execution of our tasks; the supply of magnetic data carriers has been reassuring.

Magnetic Tapes, Magnetic Tape Units

As can be seen from the table the great majority of the magnetic tape equipment to be found at our institute is the ESZ 5012/01 type of Bulgarian manufacture. The units must be compatible with each other and with the magnetic tape background storage of the other configurations. We are not thinking primarily of the compatibility of the factory parameters of the equipment but rather of the compatibility necessary for the undisturbed conduct of processing; coordinated work requires that output tapes can be read without difficulty on any of the magnetic tape units. We ensure this by having the technical experts calibrate the equipment to the same starting tape--an IBM master skew tape of 800 pbi. At least twice each year we check compatibility among computer centers and the compatibility of units within one computer center is checked monthly. We use the results of these full-circle compatibility tests in the area of magnetic data carrier acquisition, among others. We would like to share a few practical experiences discovered in the course of operation:

--In the course of acquiring magnetic data carriers we try to see that each computer center uses magnetic tape from the same manufacturer.

--It is a general experience that any of the magnetic tape products mentioned--with the exception of a few special cases--can be used equally well on the equipment used by the EGSZI.

--Special cases:

In the case of MEMOREX products, we experienced frequent slipping on the ESZ 5012/01 equipment. The cause of the phenomenon is a tape surface polished excessively fine, which spares the read/write heads but does not provide sufficient adhesion at the surface of the advancing wheel.

Writing with RACAL magnetic tapes is not sufficiently reliable on ESZ 5017 equipment. The units read even their own writing with a high error percent and they frequently proved unreadable on other types of equipment, although the magnetizability and information-preservation parameters of the RACAL tapes do not deviate from those of other products. We should note that we did our tests with a newer series tape too, lest we draw general conclusions from experiences with a faulty series.

We ordered ORWO tapes one time in 1978. Our experiences were not favorable. After brief use, the magnetic layer was worn off the carrier and the mechanical properties of the tape were not satisfactory.

Equipment with automatic tape feed cannot be loaded with WABASH tape; the carrier is too stiff and does not bend adequately.

The large-volume magnetic tape use makes it impossible to test magnetic tapes individually prior to use. In the case of known products, we accept the testing done by the manufacturer, because most manufacturers test their tapes before releasing them for sale. In the case of new products, however, we do magnetizability and life-expectancy tests on a sample and inform the shipper of our experiences.

[Jan 82 p 7] Magnetic Disks, Magnetic Disk Units

[Text] The great majority of the magnetic disk storage in our computer centers consists of 29 Mbyte units of Bulgarian manufacture. These units are subsystems of the FSZ 1022 and ESZ 1040 configurations. Many of the magnetic disk data carriers used are disk packs from various manufacturers corresponding to the IBM 2314 type.

The priority requirement for magnetic disks is compatibility within the center between disk-drive units. A less essential requirement is compatibility between centers because in general information exchange between computer centers does not take place on magnetic disk and also because the ESZ 1020, the SIEMENS and the IBM center are not compatible at the drive-unit level in regard to the computer centers with the ESZ 1022 configuration.

Technical experts assure compatibility within the center by calibrating the equipment to information on a master disk. In every case, the master disk is a type offered by the firm manufacturing the equipment. On the basis of

operational experience, there is no substantial deviation between the useability of the magnetic disks of BASF, SCOTCH, CAELUS and IZOT manufacture used by the EGSZI.

In the case of magnetic disks, we begin testing with a mechanical check of the disks being put in use; in the course of unprofessional shipping the disk surfaces may be deformed. If a deformed disk pack is placed on the drive unit an immediate breakdown occurs. The air filter must also be checked; it must be precisely in place, otherwise dust from the unfiltered air will significantly reduce the life expectancy of the disk pack. After this the procedure continues and ends with initialization.

Storage and Handling

It is best to store magnetic tapes in an air-conditioned, dust-free, isolated storage area. If air-conditioning is not possible then the tapes must be brought to the machine room at least 2 hours before they are to be used so they can take on the temperature and humidity of the machine room. In the computer center of the EGSZI, the tapes are separated according to their function and are placed in the machine room or data-storage area.

Handling Magnetic Tapes Used in the System

The tapes are regularly cleaned twice yearly and the number of their superscripts registered. Cleaning can be done quickly with mechanical tape-cleaning equipment.

The institute has tape-cleaning equipment manufactured by Control Data and KYBE and this regularly "travels" between computer centers. The maximum number of rewritings is 200, after which the tape must be scrapped as its remagnetizability deteriorates due to residual magnetism. Tapes not regularly used must be rewound at least twice a year. It is best to do this at the same time as cleaning.

Requirements for storing magnetic disks correspond to the requirements for storing magnetic tapes. The difference is that disk packs must be brought to the machine room at least 3 hours before being used. Handling disk packs is much more demanding work, partly because of their great value and partly because of their weight. One regular task is to check the air filters on the bottom of the disk packs, and exchange them if necessary. The frequency of the checks is always a function of the cleanliness of the machine room, but it should be done at least twice a year. If they are not mechanically damaged, the air filters removed can be washed in ultra water and reused. Opinions differ regarding the necessity of cleaning disk packs. Manual cleaning should be done circumspectly and only in justified cases because it may do more harm than good. The stock of disks should be cleaned once or twice a year with automatic mechanical disk-washing equipment. The institute does this with RANDOMEX cleaning equipment.

The magnetic surfaces of the disk packs are on a soft aluminum carrier. The disk packs should not be subjected to great acceleration because the disk

surfaces will be deformed. A disk pack which has been dropped or hit must not be put on a drive unit! It should be put on the axle of the drive unit only slowly. Experts at the institute use a Disc Pack Inspector device to check disk packs which have been dropped or hit--the device can check deformation of the disk surface and the magnetic layer. The vertical play of disk surfaces cannot exceed plus or minus 0.008 inches (plus or minus 0.2 millimeters). In checking the magnetic layer, spot damage cannot go beyond a diameter of 10 centimeters and streak damage cannot go beyond 10 centimeters in length.

Life Expectancy, Faults, Repairs

In regard to life expectancy, one should consider the following: information-preservation properties of the magnetic data carrier; and life-expectancy problems deriving from frequency of use and from transport.

Information Preservation

In regard to the information-preservation properties of magnetic data carriers--as a function of time--we should note that for the great majority of our services, long (several years) storage is not a priority consideration. In the case of our monthly batch processing, we preserve files for 1 month and the longest storage time between modification of certain basic data banks is 1 year, the file is used with monthly querying. Archive magnetic tapes of the customary size (a generation) provide a safe reserve for the magnetic disk basic files of certain enterprise data--even considering security and secrecy requirements. Naturally we also have information preserved on magnetic tape and used for several years. We can say that in the case of the magnetic data carriers regularly used at our institute and described above we have not met with a case where information loss could be attributed to the defective nature of the preservation properties of the data carrier.

Use

In the case of magnetic tapes, it is primarily the stretching of the carrier primary material which causes faults, first ones which can be corrected (built in hardware repetitions or possibilities given by a special software system) and then ones which cannot be corrected. This phenomenon appears largely at the beginning of the tape and thus the fault can be eliminated temporarily by cutting it off. Naturally this method can be used only to a minimal degree per spool (about 300 feet) but even then the tape cannot be used for every task. With the above method and adhering to what has been said about handling, the average life expectancy of a working tape is 1.5-2 years on the basis of our measurements. For those used in archives this time is a good bit longer.

A fault in the magnetic emulsion layer can be demonstrated quickly in use, but the frequency of occurrence is not great. If such faults appear in large numbers in the same shipment then one is justified in making a claim.

Magnetic-tape testing during operation is done with the Recorder File service of the operating system. Magnetic tape fault statistics are prepared in the operating systems of our configurations, with a minimum storage capacity of 512 Kbytes. The information is reviewed weekly and measures are taken to remove the faulty tape from work.

Faults appearing in the layers of magnetic tapes in the course of initialization and testing prior to lasting use can be eliminated by designating reserve tracks. We have not met with a case where there were not enough reserve tracks to avoid faults deriving from this.

Removing a disk from work during operation takes place according to the frequency of the error messages of the Data Check operating system attributed to one disk pack. Then the surface and mechanical parameters of the disk pack taken out of use are checked by technicians. After inspection the disk pack is corrected or reinitiated. The life expectancy of magnetic-disk packs in the course of lasting use is influenced primarily by the head-crash phenomenon. The causes are: dirt on the magnetic layer; the breakdown of the head assembly (or a single head) on the drive unit; or careless handling (for example, putting a good disk pack on a unit with a faulty head).

Such a disk pack must be taken out of use immediately!

In the past 2 years it has become possible to repair faulty disk packs with a patented procedure. The essence of this is that the faulty disk surfaces must be replaced; in general, one can get two good units from three faulty ones. This repair is done as a joint undertaking with MIKOV. The method was proven by us and is very economical; we have met with no faults from the repair. It is rarely necessary to do any scrapping except for the magnetic-disk packs remaining after the repairs, which must ultimately be scrapped. Thus we can say that practically the life expectancy of disk packs if 5-8 years.

Transport

In regard to life-expectancy problems of magnetic data carriers connected with transport we can talk about the shipping of large quantities of magnetic tapes.

In our practice there have been only mechanical problems (breaking, deformation). These arose either from careless placement in the transporting vehicle or from a vehicle collision. In general such problems cannot be corrected and the data carrier must be scrapped.

In the course of studying life-expectancy problems of magnetic data carriers used by us, we got results justifying the factory data; we have had no objections in connection with life expectancy for the types mentioned.

8984
CSO: 2502/61

EFFECT OF ONLINE INFORMATION TRAFFIC ON OVT COMPUTERIZED PROCESSING

Budapest SZAMITASTECHNIKA in Hungarian Dec 81, Jan 82

[Article by Akos Bodlaki, Janos Dobra and Dr Laszlo Kiss: "Effect of Online Information Traffic on Computerized Processing at the National Electric Power Distributer [OVT]"]

[Dec 81, p 8]

[Text] In the past 10 years the foundations for computer technology culture have been created in our homeland also in the area of both manufacturing development and use of computers. In the Sixth Five-Year Plan further progress can be expected primarily with the efficient use of computer technology tools and methods in a broad sphere of production and information processes. The justification of this goal is supported by the fact that we are in a period of a search for ways to convert to an intensive economy and computer technology will have an ever greater and more responsible role in the solution of this epochal and not easy task.

Around the world one can observe that efficient and modern management takes place with the close coordination of production and information processes, which can ensure the unity of planning and management and of organization and guidance. In the production, transportation and distribution of material goods the elements of information systems include economic and technical planning within production and in the areas of production and services. Such information systems are increasingly built on production and services. Such information systems are increasingly built on production processes and are becoming determining factors for enterprise management. Systems based on the exact measurement of objective parameters and generally made up of closed, feedback loops combine the achievements of computer technology and control technology (automation).

Automated guidance systems for technological processes have a close systems technology link with production control and operational information systems and thus constitute a foundation for purposeful, flexible and dynamic enterprise activity. Thus the use of computer technology tools and methods is constantly expanding.

In our homeland, computer technology applications directly linked with production processes still represent a new professional profile. The recognition that strengthening such tasks in enterprise applications is justified was formulated among the goals of the Sixth Five-Year Plan of the Computer Technology Central Development Program:

"In the Sixth Five-Year Plan period, enterprise applications must serve directly an increase in economic efficiency and must help to raise the quality of goods and services. Among the elements of enterprise leadership information systems, we should develop economic and technical planning and production guidance and accounting and the management of costs, stockpiles, fixed assets and manpower, keeping in mind the harmony of organization, automation and computer technology applications, an improvement in receptivity and ensuring the personnel conditions."

An appropriate role in the attainment of these goals will be played by the spread of automated planning, by computerized data collection and processing systems and by automated computerized technological process control. In connection with the latter, for example, we have pointed out that the role of efficient automation in our homeland today is primarily in ensuring production factors interdependent with the homogeneous (even and good) quality of manufacturing and products and in energy and material conservation.

Some of our industrial enterprises recognized in good time the advantages of applying computer technology, for example, in regard to automating technological processes, and they took the necessary steps in time. It is our plan to introduce a few examples in our journal, showing the effects of computer technology applications which build on and supplement one another.

With our series now starting the goal will be to show computer aided applications based on a coordinate unity of production, organization, business and accounting processes. Publishing these examples may serve as a lesson and may draw attention to the creation of additional successful enterprise applications.

--The Editors

The key question in computer applications--whether they be business, process control or other--is the relationship of the computer technology system used and the environment in which the computer is used. This relationship can be described with many parameters (the computer technology information and attitude of the users, the information of the computer technicians concerning the applications environment, etc.) but, of these, the data going into the computer and the data put out by it carry within themselves the "effect" of all the other parameters.

In our article, we will describe a concrete application, the computerized systems guidance of the OVT, seeking an answer to how the "goodness," authenticity and reliability of the input and output data affect the successful and efficient execution of the user functions.

We believe that in every computer application the economy, legitimacy and effectiveness of the application are fundamentally influenced by the above properties of the input and output data.

We consider the OVT application suitable for an introduction of these problems because we have here a use, within process control, which is critical from the viewpoint that the consequences of errors appearing in the input and output data appear immediately in the responses of a technological system, namely the electric power system. It is well known that a fundamental characteristic and problem of electric power production and delivery is that electric power cannot be stored, that is, at every moment the consumer demand appearing must be in balance with production and import.

In addition to this, the OVT application--because of its process-control character--shows more directly and with greater contrast how the effect of irregularities appearing in the input-output data chain (with which the computer is linked to its environment, and with which it thus forms a closed loop in the online or offline mode) appears in the system to be controlled. Where it is not expressly a process-control case, this effect mechanism may appear less directly in time and space, influenced by subjective factors, thus frequently washing out the cause-effect interdependencies. Practicing computer technicians may have witnessed many unproductive debates where the user vilified the computer processing and the computer technician sought the error in the bad data provision or the unprofessional use of the results.

To show this effect mechanism, we will describe two concrete functions, comparing the computer-aided solution with the classical solution, prior to the computer age. In this way, we would like to show how the elimination at the given level of the human or technical errors appearing in the information chain between the computer and its environment (or, in our case, between the controlling system and the system to be controlled) affects the successful execution of the control functions.

These two functions are:

--the storage and use for technical or business purposes of data obtained from the process, and

--closed loop, real-time control of power plants.

Before we turn to an investigation of the above functions, and of the link between input and output data, let us describe what we mean by the "goodness" of the input and output data.

In the broader sense the "goodness" of data is characterized by the following parameters: time relationships (real-time, timeliness, etc.), content characteristics, formal characteristics, availability and reliability.

Keeping the time relationships "in hand" is a key question for every application. In essence this means that the timing of input and output data, the processing and the output should be such that in the offline or online closed loop formed by the computer and its environment the functions should be correctly executed at the time dictated by the user environment. These time relationships can extend from strict real-time relationships to daily, weekly or longer cycles, as a function of the type of use.

The importance of the content and formal characteristics is self-evident. Let us only stress here the especially important data precision in process-control applications. Beyond a certain limit the imprecision of data, which can result from technical or human (subjective) factors, makes questionable the substantive correctness of the data.

The availability of the input and output data is of equal importance with the preceding parameters. By availability we mean both time relationships (data delay and frequency of data loss) and the frequency with which content or formal prescriptions are violated. In either case we are talking about the frequency of the generation of unusable data.

In the following examples, where possible in an obvious way, we will also touch on the relationship of requirements deriving from the above parameters.

Even before the appearance of computers the storage of process data was a natural function in the electric power industry--to provide operational information for ministry and trust leaders, for short- and medium-range planning of energy production and to perform statistical evaluations with the aid of operational data.

These functions required from those guiding operations (the OVT) the collection of data basically characterizing operations--hourly power plant output, peak-time values, import and export performance and energy values, network frequency values, switching events, etc.

Some of this information could be read from control room metering devices (line writers, numerical registers, etc.) and the rest came by telephone.

Even with the most disciplined work, one could obtain data of only limited quantity and precision. In certain cases, the information chain was made up of more links than necessary, which obviously had an effect on the precision and reliability of the information. For planning and statistical purposes, for example, the information was not sufficiently differentiated or of sufficient density.

When the NIMINFO data bank was prepared in the Electric Power Industry Research Institute (VEIKI) and the TIMEA technical planning data bank was prepared in the Hungarian Electricity Works Trust, the processing phase of the mechanization of leader information and technical planning was greatly modernized. But data input, in terms of quantity and differentiation (data types, number of types, etc.), did not follow in every area the possibilities of the data banks and of planning processing. In this phase, the data went into the computer from documents and reports and partly from Telex tapes. The timeliness, precision and reliability of the data were not satisfactory and were difficult to check by the processing sites because of the long information chain containing subjective elements.

The online processing, condensing and storage of operational data characterizing the electric power system could be solved in an obvious way--thanks to the existence of an already available real-time data base--with the HALDIS (Hungarian Automatic Load Dispatching System) system put into operation at the OVT.

Characteristic data reach the computer in an online and real-time way in a cycle of a few seconds via a telemechanical system from the 31 stations and power plants of the country. The chief use of these data is operational system control but in addition the storage of data, after condensation from a real-time data base, appeared as a useful function and self-evident possibility.

At present, the stored data is sent on magnetic tape to the VEIKI computer center for further processing. The data stored are: data characterizing the operation of the electric power system (A group), telecommunications error information and events (B group) and characteristic data of closed-loop power plant control (C group).

The A group is interesting in our case. Statistical processing of data in the B and C groups already takes place in the OVT. In this way, for example, the state of the telecommunications system can be watched continuously, in the statistical sense.

We store the following chief data types in the A group; wattage and unproductive output and voltages of important power lines and power plants, power values (MWh) for power plants, import-export energy values (MWh) and power and frequency data deviating from what is prescribed.

The storage of these data is hierarchical in time. An hourly data base is prepared with appropriate selection and condensation from the real-time data base and a daily data base is prepared from the hourly data base. The daily data bases are stored on disk, going back 5 days. All this is necessary for operational control purposes, but it also makes possible further processing.

Every day, the fifth day data base is put on magnetic tape, in an organization of one day equals one data file. Every datum has a bit indicating "correct data," "bad data," and "manually entered data." This makes it possible, when actualizing the data bank and doing planning calculations, to

process the data in accordance with the qualifying bit. In this way we have available a data file recorded online, in real time, checked and evaluated by software in regard to both form and content. This is used for the following planning, statistical, etc. purposes or provides input data for the NIMINFO data bank, greatly increasing the precision or reality content of planning functions and statistics:

--an increment cost value characterizing the economy of electric power production (cost for one MW extra production) as a monthly/annual average, for peak periods and for day and night periods;

--calculation of power plant production, import performance and total national load as monthly/annual averages by type of day (work day, free Saturday, holiday, etc.). These data are indispensable in planning energy needs and in calculating losses during transit across the country; and

--calculating duration diagrams for total national load, use of international power lines, development of import schedules and actual import.

On the basis of experience it can be said that in the production of input data switching from the traditional method to the online system described above had the following advantages in the area of archiving processes:

--human labor expenditure in data collection and preparation was reduced to a minimum at the source sites (substations and power plants) and at the central guidance site (the OVT);

--the reliability and precision of the data increased at the same time;

--the coherence of the data, one to another, improved by orders of magnitude as compared to the traditional method;

--data condensation takes place on the basis of such a large amount of data as to have statistical force; and

--the data flow chain shortened, the subjective factors are of minimal effect, data flow can be checked and the source of errors can be discovered easily.

Today, after realization, it can be said, thanks to the online generation of input data, that the overwhelming majority of planning and statistical processing makes use of these data. The effect of this appears directly in planning achievements and in the precision of statistical values, proving the favorable effect of an online process control system on enterprise guidance economic processing at the higher level of the hierarchy.

[Jan 82, p 8]

[Text] Closed-loop, Real-time Control of Power Plants

Power plant control plays a vital role in the already mentioned basic task of supplying electric power, constantly satisfying the quantitative and qualitative needs of consumers in time.

What all must be taken into consideration in regard to control?

--The momentary consumer demand must always be satisfied.

--Energy exchange must be carried out with the cooperating energy system according to a definite plan.

--Electric power must be produced as cheaply as possible.

--The behavior of the system must be foreseen and one must prepare to follow the changes (changing consumption).

--All this must be done while sparing the power plant park.

Control activity, especially in a critical state, requires real-time, reliable, coherent data from every system element where essential influencing events occur (power plants, international power lines, network transformers, etc.).

What do these requirements mean?

Real Time: Changes must have an effect at the moment they occur.

Reliability: Information free of distortion which actually describes the conditions.

Coherence: The lack of data characterizing the energy system at one and the same time results in control for a condition which does not exist.

Input Data: The effective performance of the power plant, the effective performance of power lines, frequency, frequency changes and the import balance.

The Control Process

At the OVT side:

a. analog or digital measurements, especially a measurement of the import balance;

b. detecting deviation from the schedule;

c. deciding on intervention;

d. distribution proportional to the increment; and

e. issuing orders (with DIDO type telemechanics or by telephone).

At the power plant side:

f. automatic or manual distribution of the order among the power plant blocks;

g. automatic or manual influx of turbine steam; and

h. changing the effective output of the powerplant.

In the case of traditional control, all intervention was entrusted to the dispatcher; he decided whether or not a change was appearing in the import balance. The experience of the dispatcher determined the quality of the control. His action was especially critical at times of swift load change.

If he was 1-2 minutes late in initiating a load change, for example during the morning increase, then the power plants could not catch up with the increasing load. The timely intervention of power plant personnel was similarly critical. Among the factors to be taken into consideration in control there was a virtual absence of estimative activity (one could estimate only on the basis of experience); fulfilling the requirement for planned energy exchange for an accounting period depended on know-how (in a bad case, if there was an under- or overdraw at the beginning of a half hour accounting period and if they tried to balance this out completely in the second half of the period, it produced constant oscillations and a very bad starting condition for the next half hour draw.)

The throughput time for control, from the detection of a deviation through intervention to an actual change in production, could take from 1-2 minutes to 15-20 minutes, which in many cases proved to be too long.

In such a case, when, in the event of an increasing import balance, the reaction of the power plants was late by 10 minutes due to a delay in the dispatcher's decision and the intervention, this meant an overdraw of 50-100 MW, which, on one occasion, caused a loss of several hundred thousand forints. In addition to the damage caused by the delay a case could arise where the delayed control of the power plants took effect in an import balance situation in the opposite direction. Several such errors in one shift could cause a loss of 0.5 million forints.

In the following, we will try to illustrate what an improvement could be achieved with closed-loop automation of control in the precision and economy of carrying out the control function.

How is all this done with a computer?

The computer carries out the following control functions:

--it continually follows deviations from the prescribed schedule values;

--it estimates the load changes to be expected;

--it integrates deviations from the prescribed schedule (it is not intended to follow every deviation in that half hour);

--on the basis of the above and in accordance with economical work points it sends orders to the power plants;

--it sends orders to the power plants automatically via the telecommunications equipment; and

--it constantly displays the most important characteristics of control on a color screen.

There is no decision delay; qualitative differences between control periods due to the mentality of the dispatcher are avoided; and control takes place on the basis of reliable data by aggregating the incoming data and checking their authenticity. The guiding dispatcher watches the computer, thus realizing a control policy depending on the period and possibly intervening in extreme cases (with the exception, naturally, of maintenance of the power plant configuration data and limits representing the control data base--this is done regularly). Computer sensing guarantees the real-time, coherent character of the data. Computerized control can react immediately to large and unidirectional changes; indeed, when developing a control strategy it can take certain changes into consideration in advance, by estimating. Long-range estimates made with the computer can aid this also.

This example illustrates how subjective human factors are removed from the decision and intervention chain of the control cycle, going beyond the use of a modern control algorithm, so that the real-time nature, coheren-e and reliability of the output data (orders) and interventions enter a qualitatively higher category. According to our data thus far, the introduction of computerized closed-loop control brings a profit of 40-50 million forints per year as compared to the classical control method; thus the computer investment is paid off in about 2 years. This profit derives primarily from swift, real-time, and thus much more precise, import activity and from economical fuel use. We have not included here the profit deriving from sparing the power plant park, since this would be difficult to calculate or estimate.

Summing Up

In this article we have tried to illustrate the effect on the processing of various parameters connected with input and output data in an area where a few years ago system control and the related offline processing were done in the traditional way. This online, real-time process-control system can also provide a good example of what the online treatment of input and output data means from the viewpoint of the economy and utility of processing.

Our experience shows that the success and utility of computerized processing are fundamentally influenced by reducing to a minimum the role of subjective elements in the information chain between the computer and its environment so that it has a simple organization consisting of few links. In other words, this means that one should strive to set up a direct online link between information sources or users and the computer and should strive to see that there is harmony between the requirements for computerized processing and the environmental structure and organization of the user. Naturally this represents various difficulties in various applications areas, in many cases tasks which are difficult to solve at present, but the economical

technical possibilities now developing (very intelligent elements at a cheap price, computerized data transmission networks, etc.) and the fact that informatics is becoming an everyday practice justify the hope that we will gradually reduce the gaps existing in many cases between the computer and its environment, thus gradually reducing the problems deriving therefrom.

8984
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PUBLIC DATA NETWORK OF HUNGARIAN POSTS

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 9

[Article by Pal Horvath: "Public Data Network of the Hungarian Posts"]

[Text] The spring of 1981 brought a significant event in the development of the data transmission service of the Hungarian Posts--the public, connected-line data network was opened. Great expectations in professional circles preceded the opening of the network as both subscribers and the Posts expected from it an improvement in data transmission possibilities.

Justification

Since the beginning of the postal data transmission service, in 1968, data transmission needs have been satisfied by connected and direct links in existing networks and telephone networks. A connected DATEX network capable of transmission at speeds up to 200 bit/s has also been available since 1971, but it did not become popular and in the spring of this year the new data network took over service to its few subscribers. The great majority of the data stations were established on the telephone network. This network proved less and less equal to the needs posed by quickly developing remote processing, partly because it was not designed for data transmission and partly because it could not be called perfect even as a telephone network. The Posts created the data network before the quality of the postal service could represent a serious obstacle to the development of data transmission. This network serves expressly to satisfy data transmission needs.

There are three types of data networks: line-connected, batch-connected and leased-line (not using connection). The Hungarian network is line-connected. The characteristics of data networks are defined by the series X recommendations of the CCITT. The Hungarian data network meets the pertinent CCITT recommendations.

The European Situation

In the course of recent years, public postal data networks have been opened throughout Europe one after another. In addition to leased-line networks, some of the postal department opening connected-data networks opened batch-

connected networks first, some opened line-connected networks first. By the middle of our decade, most developed European countries are expected to have all three types of data networks, showing that there is a need for all three. The Hungarian Posts has begun efforts to develop the service further.

Line-connected data networks similar to ours, suitable for serving asynchronous and synchronous terminals at low and medium speeds, are operating in the FRG (DATEX-L) and in the Scandinavian countries (the Nordic Public Data Network). An asynchronous line-connected data network with a maximum speed of 300 bit/s is also available in a number of countries (for example, Austria, Switzerland and Italy). Hungary is the first of the socialist countries to establish a data network.

By opening the data network the Hungarian Posts entered the front rank of European countries--in regard to the time of opening and the technical level of relization alike--and in accordance with its possibilities it will strive to maintain a favorable position.

Chief Characteristics of the Hungarian Data Network

Connection in the network is done by a NEDIX 510 A center manufactured by the Japanese Nippon Electric (NEC); this unit is completely electronic, has stored program control and uses a time-distributed switching principle; it also functions as a Telex center. (See SZAMITASTECHNIKA, January 1981--the editors.) The system is a multiprocessor design. The high reliability required is ensured by doubled hardware, self-checking of the system, automatic restart and diagnostic possibilities, among other things.

The transmission technology of the network comes from the NEC also. Time-multiplex equipment installed in the large provincial cities and some Budapest telephone centers connects to the center via high-speed transmission. The terminals are connected to the center or to the outlying time-multiplex equipment by data circuit-terminating equipment (DCE, according to the CCITT English terminology). According to the type of transmission path used, there are two versions of the DCE, a simple one providing base band signal transmission via metal connectors and a more expensive one designed for transmission on telephone channels. The number of DCE versions is further increased by two basic types of subscriber interfaces, the so-called V.24 interface and the X interface.

A developed, centralized maintenance system is called on to ensure operation of the complete network. This ensures the possibility of limiting errors, from the central site all the way to the subscriber interface.

The CCITT recommends DTE-DCE interfaces for data networks, which are much more advantageous than the V.24. Interface characteristics are set forth by the X.20 recommendation for asynchronous, low-speed equipment and by the X.21 recommendation for medium- and high-speed equipment. The data network has switching devices in accordance with both the X.20 and X.21. It would be desirable for the use of these interfaces to spread as soon as possible; for this reason the Postal Central Telegraph Office (PKTH) is supporting their development and use.

With its many lines, the V.24 interface offers innumerable realization possibilities. Unfortunately, the manufacturers, making use of the possibilities, have produced a broad variety of interface versions. The Hungarian data network, however, is suitable for any V interface device because in this case, as a supplement to the DCE, it installed a network control unit (NCU) which reduces the many V interfaces to a uniform X interface. Manual calling and manual or automatic calling-receiving are possible with the aid of the NCU. With the V.24 interface one can initiate an automatic call to contact only one party, as a so-called direct call.

Connecting any subscriber requires a four-wire subscriber line.

Services

Table 1 shows the characteristics of the subscriber service categories provided by the network.

Table 1: Subscriber Service Categories of the Hungarian Data Network

Service category	Polling Speed bit/s	Polling Code	Polling Character structure	Data transmission Speed bit/s	Data transmission Character Structure	DTE mode
1	300	IA5	11 element	300	11 element	start-stop
2	110	IA5	11 element	110	11 element	start-stop
	200	IA5	11 element	200	11 element	start-stop
2' (DATEX)	dialing, 10 imp/s			max 200	not fixed	asynchronous
4	2,400	IA5	--	2,400	--	synchronous
5	4,800	IA5	--	4,800	--	synchronous

The network provides full duplex transmission in any category, thus making possible the use of bit-oriented line-control procedures.

In addition to calling a number with the input of the complete calling number, the basic service, the network provides the following special service: direct calling, identifying the calling and called line, closed subscriber group, closed subscriber group with outgoing call rights, forbidding calls into a closed group, forbidding calls from within a closed group, forbidding call initiation, forbidding reception of a call and generation of serial number.

The data network service is complete in that the Posts provides all the devices for transmission and network connection--including the NCU and the DCE--and takes care of maintaining and repairing them. The new data transmission possibility is public and nationwide; that is, it can be used by anyone from the territory of the country. The network does not protect information transmitted between subscribers from bit errors. If necessary, the subscriber must take

care of error protection. In the synchronous categories, the network makes possible completely transparent transmission.

Even after putting the new network into operation, the Posts provides the earlier possibilities for data transmission. The data network is simply a new alternative for satisfying data transmission needs, one which is more advantageous for both sides.

It is possible for remote data processing systems operating on the telephone network to switch to use of the data network without trouble.

The system of data networks will develop into a world network similar to the TELEX network. It is foreseen that the Austrian data network will be accessible from the Hungarian network. Foreign networks will make it possible to reach other networks, by transmitting. (We regularly inform our readers about building up international contacts in the columns of SZAMITASTECHNIKA--the editors.)

It is the goal of the Posts to see that the bit error ratio will be no greater than 10 to the minus 6 for the great majority of subscriber links possible on the network.

The connection time provided in the synchronous categories, averaging only a tenth of a second, makes possible a new type of connected-network operation for terminals and computers. If a sufficient quantity of data awaiting transmission is not available, it is worthwhile to break the connection immediately because making a new connection represents practically no time loss and is sure to be successful. By virtue of caller line identification, partners in logical contact can reject a call from an outside party before contact is established. Thus the correspondence fee calculated on the basis of the duration of the connection can be proportional to the amount of data transmitted, which means very economical data transmission. Naturally, the exploitation of this possibility is possible only with any type of X interface.

Table 2: Maximal Values of Times Characterizing Making and Breaking Contact

DTE mode	Duration (ms)	
	From call to polling signal	From sending of break signal to state of rest
Asynchronous	150*	490**
Synchronous	50*	50*

* maximum time

** maximum break time as determined by signal system

Fees

Data network fees are contained in price agreement VI/14/1981 (AT2) of the Ministry of Transportation and Postal Affairs and in Directive 9/1981 Vig. of the Postal Director General. (Both appeared in Issue 2, 1981, of the POSTAUGYI ERTESITO.) A subscriber information pamphlet containing the fees is available from the Data Transmission Group of the PKTH. It will be mailed upon inquiry.

Increasing the use of the data network naturally depends on the fees as well as on the advantages of the completeness of the service and on the quality of the service provided by the network. From the viewpoint of users, it is an advantage that despite the extra service the data network is not much more expensive than the telephone network and for a significant proportion of needs it even offers a substantially cheaper data transmission possibility.

The economic advantages of the data network can be exploited especially in the case of remote processing systems operating with a large number of data stations throughout the country. According to the experience of the PKTH the present subscribers and the significant number of applicants chose the network largely because of its economy.

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SCIENTIFIC DEVELOPMENT, REQUIREMENTS DESCRIBED

Scientific-Economic Consultation

Warsaw RZECZPOSPOLITA in Polish 1 Feb 82 p 4

[Interview with Zdzislaw Kaczmarek, scientific secretary of the Polish Academy of Sciences, by Witold Blachowicz: "Responsibility of the Scientists; Utilization of Research Centers, Consultation for Economic Elements and Management Organs"; date and place not given]

[Text] [Question] Witold Blachowicz: The first moves within the framework of economic reform have been made. The reform itself, applied under the specific conditions of martial law and great economic crisis, will certainly have a tremendous effect on almost all field, including science. Under these circumstances, therefore, which directions of research should be regarded as being most important and most meaningful for our country?

[Answer] Zdzislaw Kaczmarek: The starting point for scientific activity, under normal conditions, should be a familiarity with the global concept and social and economic directions of Poland's development. The difficultylies in the fact, however, at that the moment there is no such concept.

Since about the mid-1970's we have had no long-range (and implemented) development programs, and long-range economic planning was replaced by immediate plans with a time frame which did not generally exceed one year. At present, we do not have a 5-year plan nor a long-range plan.

Thus the main tasks confronting science derive from the necessity to surmount the present difficulties and certain general development proprieties that are characteristic for the present stage of socialist building in Poland.

Speaking of the most important research directions today, in my opinion the following should be mentioned:

--research leading to savings in raw materials and energy, and application of new energy sources--work which would assist in seeking, discovering and utilizing our own raw-materials sources;

--research which would assist in increasing the production of food and pertain also to agriculture as well as processing, leading to a drastic reduction in losses of food articles;

--work in environmental protection.

Obviously these examples of directions do not exhaust all of even our most critical needs.

[Question] Those were directions that cover the entire scope of our science. Let us now limit this scope to PAN (Polish Academy of Sciences)--its tasks, capabilities, and also its co-responsibility for the past and the future of the Polish economy, Polish science and culture, and our social development.

[Answer] The main task of the Academy of Sciences is to be concerned about the development of those studies which bring original and lasting values to the general achievements of science and culture. We feel ourselves to be less competent to solve tasks connected with the adaptation of scientific results to production practice. PAN and its centers have been assigned, somewhat statutorily, basic research, which is the starting base for developing applied research and practical applications. But at the same time our centers in conducting basic research work together with the economy. For example, in the PAN chemical institutes many new technologies have been developed. In the area of physics, many problems have been solved for engineering needs, for example, for electronics development. In the engineering sciences, for example, such institutes as the Institute for Basic Technical Problems, the Institute of Fluid Flow Machinery, and the Research Center for Basic Metallurgy, have brought their input into the development of Polish mechanics, the production of turbines and ships, in the development of new materials and in steelmaking. There are many examples of interest in practical problems in the area of medicine, biology, and in the agricultural sciences.

Reports prepared by scientific committees of PAN also are tremendously valuable. In the area of professional reports alone many thorough and conscientious reports have been prepared pertaining to the most important fields of socio-economic life, as for example, the state of energy, transport, education, society's health, raw materials reserves, etc. If we are willing, we can find the key to the solutions of many very difficult problems. We are now in the process of preparing a number of professional reports dealing with the present crisis situation. We must say here, however, that, unfortunately, too often use has not been made of this enormous wealth of knowledge and also experience!

[Question] Exactly. Under economic reform changes must also be made in the mechanisms of cooperation between science and industry and practice.

[Answer] The establishment of new relations between science and industry is at this time a matter of paramount importance. Thus far, research was financed from the state budget (for example, in 1981 about 16 billion zlotys) and from industrial funds (in 1981, over 20 billion zlotys). Means from the Technical-Economic Progress Fund were also actually controlled centrally and in large part were in the hands of the ministries, associations and the Ministry of Science, Higher Education and Technology. Now this second source will remain in the hands of the enterprises, which can, of course, assign the profits obtained for other purposes. That is why in

the science-industry system a market must be created, an economic mechanism which will force manufacturers to update their products, to apply new and more effective technologies and manufacturing methods, and all of this will require that scientific searches will have to be employed and the results of research will have to be applied. These matters have not yet been solved, but there is no doubt that along with reform, there must be a change in the whole system of applications.

[Question] It appears from this that the scientific centers will have to come forth with offers to interest the economic centers, that they will have to show more initiative. At the same time, we must remember that many enterprises and entire branches will have to fight "for their lives" in the immediate future, for a chance at survival. Thus orders, too, may be much less impressive from the scientific point of view. What then?

[Answer] Many of the circumstances which you have mentioned will undoubtedly take place. That is why it is in the interest of both the scientific communities and the country to take such action as will utilize, in the next few months, the full potential of science. I have in mind here not just research, which will require the necessary amount of time, but the utilization of existing achievements. We must, in a very short time, during the next few months, make a thorough evaluation of what is available in Polish scientific centers, and also in what areas we can benefit from the achievements of world science. The last 5-year plan should be subjected to this analysis, and the results which we have available should be offered to the economy. This type of work is now underway in PAN. We must also develop scientific consultation for economic elements and management organs. In a word, we must quickly evaluate everything that we have, use it fully, and correctly anticipate development.

[Question] We are forced to relate everything to crisis conditions, although this word was constantly present in our conversation anyway. At the same time, more and more frequently those responsible for the crisis are being sought and the finger is being pointed in the direction of the intellectuals, the educators, and the creative circles. In your opinion, could these circles, the intellectuals, not have prevented the occurrence of the crisis from the 1970's, as well as the dangerous course of events in recent months?

[Answer] Theoretically it can be assumed that a certain opportunity for prevention existed, but the authorities did not want to listen to many of the warnings and alarming reports from the specialists. Certainly most scientific reports were not taken into account. I also believe that a sweeping extension of responsibility over the whole intelligentsia is a big mistake and is not true. It is correct, however, to blame those representatives of the intelligentsia and those groups which functioned in the decisionmaking systems. They are jointly responsible for the crisis that arose. But it is still a matter for discussion as whether these groups always had a substantive basis to be regarded as being fully representative of this social group.

If, however, we are referring to the recent period, then the matter is more complex. It is true that there were, from the intellectual communities, too few public, decisive and unequivocal warnings calling attention to the fact that events are proceeding in a very dangerous direction, even though there was such an awareness of this within these circles. And here those who say that the intelligentsia should search its conscience--why was it silent--are right. A certain justification,

particularly for the technical intelligentsia, lay in the fact that during previous periods their opinions were not generally taken into consideration. Hence, possibly, the mistrust and silence during this last period.

At this point, however, we should say that although these matters are important, they are in no way the most important. The main problem on the national scale comes down to gaining the confidence of the working class which is concentrated in the 200 to 300 largest industrial plants in Poland. This is the key to solving the many unknowns that face our country. In this search for understanding and accord, the scientists can and should play a positive role.

Technical Progress - Basic Research

Warsaw RZECZPOSPOLITA in Polish 4 Feb 82 p 6

[Interview with Prof Dr Jan Kaczmarek, president of the Association of Polish Mechanical Engineers, by Witold Blachowicz; date and place not given]

> [Text] Prof Dr Jan Kaczmarek, the president of the Association of Polish Mechanical Engineers, is a distinguished specialist in the field of principles of machines technology. He manages the Mechanical Systems Plant in the PAN Institute for Basic Technical Problems.

[Question] Witold Blachowicz: The engineering community, with which you have always been very closely related, although it performs the highest scientific functions, has a specific opinion as to the tasks of science. What do engineers expect of basic research, if such a description of this research can be regarded as being completely proper?

[Answer] Prof Dr Jan Kaczmarek: It is the belief of the engineers that basic research is that which has a fundamental influence on the development of many fields, including engineering. The engineering communities include in this category both cognitive research--the discovery of natural phenomena and the laws that govern them--and applied research, which contributes new, original values, facilitating leaps in development, for example, in the field of technology. Employing such criteria, which in my opinion are correct, engineers expect that basic research will produce the most steady inflow of knowledge and information from the country and the world on new scientific developments in individual fields, and that this information will be given in such a way that the engineers will be able to quickly assimilate it.

[Question] These expectations do not pertain, I believe, only to our own scientific base?

[Answer] Naturally not. Certainly no country in the world is self-sufficient in the area of creative ideas. That is why engineers expect a flow of information from domestic centers as well as from foreign centers. Fortunately, results of basic research are published widely and in general are not covered by an embargo. This is so because knowledge of these results alone is not enough. One must know how to interpret these results and be able to make practical use of them, and the path to this is often very difficult.

[Question] One would get the impression that this flow of information goes only in one direction.

[Answer] No. The entire process of technical progress ensues from a continuous interweaving of bids, resulting from basic research, with orders put forth by technology. That is the rule. An off-the-cuff example of this may be research conducted on complete elimination of toxicity of engine exhaust gases. Here the efforts of the scientists encounter the strivings to protect the human environment, mainly the municipal and natural. We very often come across situations from which, out of experience, we get inspiration for directed basic research. In any case, the cooperation of different specialists is essential and often brings very accurate results. For example, in the program which I am coordinating, builders and technologists work very closely with scientists in the field of solid-state physics, with mathematicians, theoretical mechanical engineers, and others.

[Question] In what area can and should a country like Poland develop basic research and what should this be under crisis conditions?

[Answer] We must remember that demographically we constitute about one percent of the world's population. Therefore, we cannot expect to create a scientific base that will satisfy all our needs. Without neglecting proper development in the entire field of science, we must nevertheless make a choice and a far-reaching selection. First of all, we should develop, concentrate our efforts and resources, on those areas of basic research in which, due to our talents and creative inventiveness, we find ourselves in the forefront on a world scale, and particularly if this research is connected with domestic raw materials and economic possibilities.

In making a choice of the directions of research, we should also constantly remember to do what is necessary so that we can transmit world achievements to our science and our economic needs. By skillfully adapting the achievements of others, we can gain a great deal. There are examples of this in many countries, although Japan is mentioned most frequently in this respect.

Countries similar to Poland, developing their economy normally, allocate 10-15 percent of their total outlays for research and development to basic research. We can therefore assume that this amount ensures that science develops correctly, and as a consequence, so does the economy.

[Question] Certainly in our country, also, there are many examples of results obtained because basic research had been conducted previously. Perhaps you can give us an example from your field.

[Answer] Putting it simply, it can be said that my field is that of means of production, manufacturing the means of production, i.e., machines that produce machines. The main problem confronting us is that of improving precision, reliability, durability, accuracy, increasing the number of functions performed, and ever-higher ergonomic requirements. These severe technical requirements demand specific basic research; for example, research pertaining to systems dynamics, mechanics, wear resistance, man-machine relations, automation, control...

The examples which you requested are many. One of them may be the well-known press of Prof Zdzislaw Marciniak, which originated from deep basic research on the plasticity of metals. As a result of this research it became possible to produce objects by plastic forming, for which the press, of unconventional construction, became an executing instrument.

[Question] What should be done to increase the number of such examples as the last?

[Answer] I am in favor of feedback at all levels, between subsectors, branches, and the entire economy, and the potentials of larger scientific-research and technical groups. With such a solution we can achieve both scientific peaks of engineering as well as raise the level of the "lows". Frequent arguments that only peak achievements are important, and that matters can only be settled at the decisionmaking and scientific peaks are simply erroneous. A poorly functioning economy in each of its elements complicates the conduct of scientific research.

[Question] If I recall correctly, you were always an advocate of close cooperation of science with the economy, valuing basic and applied research to an equal degree.

[Answer] The importance of basic research lies not only in the fact that it is a constant source of technical innovations, but also in the fact that it brings its own values into science and culture. Hence the exceptional position of basic research. But we cannot underestimate the social importance of applied research and design work. Every genuine creation is socially necessary and useful, regardless of whether it is the work of a scientist or an engineer.

Preparation of Professional Reports

Warsaw RZECZPOSPOLITA in Polish 18 Feb 82 p 4

[Interview with Prof Dr Zbigniew Gertych, first deputy scientific secretary of the Polish Academy of Sciences, by Witold Blachowicz: "First the Professional Report, then the Decision"; date and place not given]

[Question] Witold Blachowicz: The report that the Council of Ministers' Sociopolitical Committee considered the government's draft resolution on scientific consultation met with great interest in the scientific community. The assumptions proposed in the resolution answer the postulates, long advanced by the PAN, particularly in the area of the necessity to prepare multi-variant professional reports and to consider the suggestions that they contain, before undertaking important decisions. We can thus expect that instances, occurring in the past, in which decisions made previously are supported by professional reports later, will not be repeated.

[Answer] Prof Dr Zbigniew Gertych: The resolution that was prepared has all of the data necessary to make it a valuable instrument by which to create the opportunity to utilize all of the scientific and creative forces and capabilities available in our country. And we are absolutely not concerned here with an attempt to promote the opinion that scientists and specialists from particular fields have been, or always are, right, but that their position, supported, naturally, by knowledge and experience, by familiarity with the world situation, be taken into account by those

who are going to make the decision, and before the decision is made. This does not at all mean that all proposals must be granted. Every decision is, after all, generally the result of certain compromises, and even the choice of the lesser evil. But it is essential that the people who are choosing the variant know all of the argument for and against. Then the extent of the mistakes can be much lower.

Speaking of great experiments, the comprehensiveness of evaluations and the propositions that they contain, are very important. And in this respect, insofar as the professional reports prepared in PAN are concerned, we are in a good situation. These professional reports were generally prepared by very numerous teams of scientists and specialists within the framework of scientific committees, composed of professionals from specific fields, regardless of their place of employment.

[Question] The idea of professional reports arose in the Academy many years ago. How did it originate and what fields of our life have fallen under the scrutiny of various teams of experts?

[Answer] The idea itself arose from the fact that as the country's economic potential developed, changes had to take place at the same time in the internal and external structures, changes in the management systems, and also a modification in the industrial production models which were in effect. All of this, of course, is deeply preconditioned--socially and politically, technically and technologically--but the social and political preconditions are very important. Hence the constant need to study the directions of these changes, to forecast the development trends, and the prepare the indispensable reforms. And so it is the task of responsible experts to show where the given phenomena are heading, what could be the results of this, and what to do in order to utilize the given phenomenon for the country's economic welfare. Such an approach and such strivings were always important, but during the period of crisis they take on an inestimable value.

Professional reports in PAN pertain to almost all of the most important fields and phenomena in our life, from the power industry and raw materials resources, agriculture and food, to social pathology, civilizational illnesses, education and water management. Included also are demography, genetic engineering, environmental protection, fuels of the future, and many other fields. During 1977-1981 alone, 35 large, central, scientific professional reports were prepared, to say nothing of numerous other preliminary studies by scientific committees representing homogeneous fields.

[Question] Irrespective of the value of the professional reports and the original concepts, knowledge and experience accumulated in them, and irrespective of the enormous work put into them by many groups of specialists, experts, recently, were not held in the highest regard by society. They are being charged with the responsibility for the mistakes that were made and for the existing crisis. Does this atmosphere not make it difficult to put into effect the Council of Ministers resolution on scientific consultation?

[Answer] I have even heard this said: "Would that you were an expert!" [spoken as a curse]. But the truth is far more complex. It is true, of course, that there were people who supported, with their learning and their name, ideas that were not the best. Such examples, to which the rule applied that the boss, the authorities, were always right, can be found in every community, and also in the scientific one. But

But the greatest majority of the ideas presented in the professional reports were based on a thorough knowledge of the subject and good faith. When professional reports are being evaluated (even those that missed the mark) one must always ask the question whether the experts had access to all of the indispensable parameters and authentic data which would determine the directions of development. It may turn out that this was not available to them. Hence their responsibility may not be total. Also it happens that during the course of preparing the professional report, external, international factors change suddenly, which could not have been foreseen, as for example, changes in the world economy produced by the increased prices of crude oil, which have a great bearing on the economic problems in our country.

Of course, there are also other dangers, for example, various pressures on the experts. For these reasons we have always been in favor of having PAN fulfill the function of a collective expert. In this way a broad horizon could be provided for the problems considered in the report, and the pressures on such an expert are not effective. In order to end this question, I will say that there are many examples where the experts warned the authorities of the impending crisis. For the most part, however, this was disregarded.

Nevertheless it is a fact that social confidence in the experts of whom you speak dropped recently. What can be done under these circumstances? The only solution is to rebuild this confidence. However, we must realize that both the Council of Ministers resolution and the best professional reports are only component elements for overcoming the crisis. But they will not change much if work productivity and quality does not improve radically, if we continue to eat up all of the imports from capitalist countries. For we are buying food from western countries in the amount of 3 billion dollars, and 2.5 billion dollars would be sufficient for the indispensable purchases of raw materials and coproduced materials in order to fully utilize our productive capacity.

[Question] The most urgent matter now is that of very rapidly utilizing all possibilities, including ideas and proposals contained in the professional reports, for the process of surmounting the crisis. Which of these prepared reports may be most useful and how do we intend to make use of them in the immediate future?

[Answer] It seems to me that first of all we must make use of the reports on the energy industry, domestic raw materials, agriculture and food, social pathology, environmental protection and water management. These are very valuable works. At this moment we are making some revisions from the standpoint of the country's needs during the crisis. We have now sent to the government the first part of the raw materials report, after making such corrections showing the possibilities of utilizing many of our own raw materials, which in the past were being bought in other countries.

We are in the course of preparing proposals for using domestic fodder for animal raising, for example, a method of replacing American corn with our own feed in raising broiler chickens. This method is already being experimentally introduced in large producer cooperatives near Lodz. In any case, it should be said here that the entire expertise on agriculture and food is completely current and can be employed without delay. It should be said here with regret, that if over the past 7 years, as we had

proposed at that time, at least part of industry had been converted to production of means of production for agriculture, the crisis would now not have been as deep. This fact is now generally understood, but making such a decision now, as proposed earlier, will not bring results for another 5 to 7 years.

Research-Development Program

Warsaw RZECZPOSPOLITA in Polish 2 Mar 82 p 6

[Article by Tadeusz Podwysocki: "Government Research-Development Programs; Coal, Copper, Electronization, Protein, Construction, Neoplastic Diseases, Water"]

[Text] Many important tasks are awaiting a scientific solution. Every expert, in one breath, can recite what is most important in the country's future: raw materials and energy, food, health protection, and housing. We have large research programs in all of these fields. Thousands of specialists have combined their efforts in many fields of knowledge.

/Seven government research and development programs were established, with the first stage covering 1976-1980. It should be added here that the program pertaining to water management will be implemented totally over 10 years (by 1985), and the remaining undertakings have been planned for a 15-year period (to 1990)/ [in boldface]. What is also important is that only the program covering the fight against cancer was a new undertaking. The remaining large government research programs were a continuation of work conducted previously within the framework of crucial problems (after partial modification).

The goal of the concentration of scientific potential was and is to obtain results of research as quickly as possible, and at the highest level. Small teams or individuals conduct studies that are prolonged. The labor-intensiveness of a research subject in Soviet or American industry amounts to from 13 to 24 people-months. But it would take a single scientist 2 years to obtain the same results. The difference is quite important and indicates the advisability of integrating teams around important government research-development programs. What are the goals of these projects? What do we want to achieve by way of establishing large cognitive and utilitarian projects?

The Community's Favorable Attitude

The comprehensive processing of coal is a problem of enormous importance for Poland. /The main goal of the government's PR-1 program is the proccssing of coal, its gasification and liquefaction, the obtainment of synthetic gasoline, and new coking raw materials. The next research program, PR-2, focuses the attention of the scientists on optimal exploitation of copper resources and the development of production of products from this raw material and its alloys. The degree of the electronization of the economy determines technical progress. The main goal of the PR-3 program, a program for the development of electronic materials and subassemblies, is to surmount the technological barrier. Research program PR-4, however, concerning optimization of the production of protein, should produce new, unconventional methods of manufacture, make the traditional methods more efficient, and make this fundamental

substance of life more economical. Housing construction is a problem of exceptional social importance. PR-5 should give this construction scientific support.

A highly humanitarian project: the implementation of a large research program to combat neoplastic diseases, PR-6, should, in 1990, result in coverage of at least 90 percent of all affected persons with causal and radical treatment and to double the number of permanent, over 5-years' duration, cures. We are approaching a period of water shortage. Only by establishing scientific, technical and organizational bases will we be able to ensure that optimal water management systems will be obtained. PR-7 serves this purpose./ [in boldface].

The Situation with Applications is Worse

Government research and development programs were well-received by the scientific community and made it possible to integrate this community around the important goals. Analyses by the Ministry of Science, Higher Education and Technology, show that the number of applications of results of work obtained from government programs is twice that of those obtained from other research. This same ministry reports that combined expenditures (1976-1980) for large, centrally controlled research programs amounted to about 50 billion zlotys, and the measurable results for the economy are estimated at 160 billion zlotys. That is, for one zloty of outlays, 3.2 zlotys of results were obtained. While outlays for work in the PR-2 program (copper) amounted to 2.4 billion zlotys, benefits in the amount of 6.4 billion zlotys were determined.

A study by the Institute of Scientific Policy, Technical Progress and Higher Education, shows that during the first 2 years of the past 5-year plan only approximately 25 percent of the means were spent on the implementation of government research and development programs. The outlays allocated by the government for these research programs could not be used up. Within PR-7, of 2,275 million in outlays (for the entire 5-year period) during 1976-1977 only 375.4 million zlotys were used. And 1,449.6 million zlotys were left from the 1979-1980 period. It is the same with the program on protein. The situation is still worse where investments within the framework of government programs are concerned. This failure to implement research projects has affected the success of some of the work. But the evaluations of the science ministry and the institute mentioned show that most government programs are implemented in accordance with the plans, and the number of delayed applications or works not performed was slight up to 1979. There were considerable difficulties in the application of results in the years after that. The materials of the Sejm Commission of Science and Technical Progress report that only 72 percent of the government research and development programs were implemented in 1980. Thirteen tasks were not executed.

The authors of the analyses prepared by the Institute of Scientific Policy call attention to a very important matter. That is, that too often the various reasons for delays and improper execution of work is determined to be the result of the objective economic situation and the limitations connected with it. These are not always reasons that can be regarded as being true and correct. The experts say that a system that is adapted only to conditions of abundance is a poor one. The essence of proper management always resolves itself to a choice under conditions of limited means. The present system of government programs (as well as crucial problems) from the very beginning had many pathological features which affected it very strongly particularly under circumstances of crisis, great restrictions and sacrifices.

Lack of Objective Criteria

The system of government research programs, in addition to its good points, also has some defects which were brought out both during the PZPR Central Committee's Twelfth Plenum in June 1978, and also in the analyses of the Supreme Chamber of Control, the Polish Academy of Sciences, the Ministry of Science and the Sejm commissions.

First of all, there are no objective criteria for the selection of research projects. Hence the practice of tacking on various subjects to really important tasks. Subjects of very little importance, unrelated ideologically to government programs, were artificially rammed through. The scientific community attempted at all costs to include in the government programs only those subjects which could successfully be implemented without cluttering up and distorting these priority goals. The adding on of various, far from the intent of the program, subjects, resulted in a partial debasement of the object of the programs under government sponsorship.

Science as Anti-Crisis Force

Warsaw RZECZPOSPOLITA in Polish 5 Mar 82 p 4

[Article by Tadeusz Podwysocki: "Science in the Process of Overcoming the Crisis; Utilizing the Scientific Potential Under Changed Conditions"; passages enclosed in slantines printed in boldface]

[Text] There are many misunderstandings, simplifications, stereotypes, deceptive hopes and pessimisms in the assessments of the potentials of science.

Some are convinced that through science all of the adversities in the economy and in social life can be overcome. This reasoning is based on science's unparalleled successes in the past. New disciplines, such as information science, sociology, cybernetics and materials engineering, have appeared. Twentieth-century discoveries are radically changing the present concepts of natural phenomena and social life. Changes have occurred in processes of production covering all fields of human productivity. Totally new materials, new sources of energy, outer-space vehicles, and computers, have been developed. Hence also the belief that science, together with technology, are able to bring society out of even the worst plights. The point is only how this science can be properly stimulated and utilized.

Others maintain that the stimulation of science and technology absorbs tremendous resources and that the effects are lower than could be obtained by allocating this same money for other purposes. According to the calculations of the experts, out of 2,400, more or less original inventions in a country such as the United States, only one finally reaches the applications stage in production. It is the same in Soviet industry: scarcely one-third of the inventions are used. Science is being charged that it has not done much to solve the most important world problems: hunger, numerous diseases (including cancer), reduction of human aggression, and the negative effects of urbanization and industrialization.

Of course, science supported by technology, is not and never will be a universal cure for all of society's ailments or a barrier on the road to economic development. There is no one factor, no one means that can create miracles. What appears is an interweaving, a whole group of different economic, social, organizational, legal and political forces which shape and exert an influence on the life of every country and nation. However, science can assist in understanding these phenomena; it can furnish knowledge on each of the factors, systems and processes. And to know and understand is already a great deal. It is already a step to directing and managing, planning and foreseeing which of the possible results is the most rational, accurate and promising.

Science and technology are not able to bring the country out of the crisis, as some would believe. But technical progress can considerably increase the national income, have some effect on management efficiency, and alleviate many negative effects of destabilization. /But at this point we must immediately add: the results of science and technology will appear only when activity in this sphere is united in true bonds of matrimony with the economy, production, the market, and investments. It is hard to disagree with Prof Edwin Mansfield from the state university in Philadelphia when he says research-development work alone has, in general, little meaning for an enterprise. Only when it is combined with buildings and equipment, production, sales, and financial capabilities, can this work bring results in the form of production of great trade importance, or technology./ What an accurate contusion [as published].

I am deeply convinced that if we are able to apply scientific-technological potential to changed conditions, than we will achieve great anti-crisis strength. There are several lines of attack available to science and technology. The human and materials potential on these lines of the front may even be determining: it will greatly accelerate the process of coming out of the crisis.

/The first line of attack for scientists and engineers is the wide range of technology and design which can greatly reduce the costs of manufacturing. This is a fundamental problem both now and in the future. It is here that the most good can be done in applying technical progress./ The application in Poland of automation systems in production processes in sugar-beet factories gives, at an average 3,000 tons per day productivity, employment savings on the order of 50-60 persons, while at the same time, production of the entire sugar-beet factory increases an average of 15 percent. In this case, technical progress means that sugar losses are reduced by about 5,000 tons during one sugar-beet processing period, and there is a reduction in thermal energy consumption (a savings of 45,000 tons of coal!).

Foreign calculations indicate that application of new technologies in the production of ammonia and construction of installations with a higher production capacity brought a reduction in prime manufacturing costs of over 20 percent. In our country we have both professionals as well as centers that are capable of developing and applying many technologies that could bring about reductions in manufacturing costs. Some of these technologies have already been developed and could not in past years get as far as the production floors. There was no shortage of obstacles in the path. Reform should bring about a demand for action by research-development facilities which would reduce production costs.

/The second line of the research-development front should cover processes that improve efficiency in the consumption of materials, raw materials, fuels and energy. The possibilities are immense and the needs are even greater./

Savings measures of a new technology in metallurgy can reduce the direct consumption of energy by 30 percent over a longer period of time. This represents about 15 million tons of standard fuel. Modernization of boilers in electric power plants would also save millions of tons of coal and make it possible to effectively burn the poorer grades of coal. There are plenty of examples. They can be cited endlessly.

/The third line for research-engineering facilities takes in the extremely important field of influence of technological and organizational progress on the degree of growth of labor productivity. Soviet and American research shows unequivocally that labor productivity can be increased by applying technical and organizational progress. If scientific-engineering progress is applied intensively, management and organization of production is improved, then the increase in labor productivity will surpass the development of the technical equipping of the work. And this, as a result, means a reduction in the capital-intensiveness of production./

Research and devlopment to increase labor productivity and improve its organization is indispensable. We refer here to mechanization, tool construction, and making transport inside the enterprises more efficient. There are many subjects that require quick solutions. One urgent matter is that of modernizing methods of management, reducing the range of idle and unnecessary actions, and giving the organizational structures more flexibility in science and production.

/The fourth line should concentrate the efforts of the scientific and technological community on solutions and applications which should assist in utilizing domestic raw materials and other materials, and on the replacement of imported, heretofore, means of production./ Technologies are needed which would aid in making use of secondary raw materials. In 1985 we will have 4 million tires to retread, and in the textile industry about 300,000 tons of valuable waste-type raw materials will be available.

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EAST EUROPE REPORT

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ALBANIA

ACHIEVEMENTS, PROSPECTS IN FIELD OF PHYSICS

Tirana BULETINI I SHKENCAVE TE NATYRES in Albanian No 4, Oct-Nov-Dec 81 pp 3-6

[Article by S. Kuneshka and P. Skende: "Physics in Our Country, Achievements and Prospects"]

[Text] Before the liberation, one could not speak at all about the development of the physical sciences and of the other natural sciences.

In the level which physical sciences have reached today, we see embodied the great and farsighted work of the party to form the scientific culture of the country on the basis of the Marxist-Leninist concept of the most massive assimilation with high social effectiveness. The bases of the present level of physics were laid having in mind the concern for cultivating, first of all, a strong training in physics and mathematics in the schools and for treating physics as one of the major formative subjects.

The creation of special physics and mathematics education, up to the fifth year of physics, by the Pedagogical Institute ensured to the country the source of the very necessary cadres in this field. These cadres worked and are working to elevate physics to a higher qualitative level in the other specialized areas; they formed the first nucleuses of good research work in the field of this science and are helping us now to take care of postgraduate physics and mathematics studies.

In the search for good scientific research work in the field of physics, the first tests in the years 1960-1970 were carried out in the field of the study of radioactivity of mineral waters and of the physical characteristics of materials of the country in accordance with the material base available and with the requirements of applied science mainly in the area of geology. During the same 10-year period, theoretical physics concentrated mainly in the field of teaching and in other modest works in the field of solid-state physics also made some first advances.

The objectives for the development of nuclear physics in our country were set in the years 1964-1967. This made it possible in 1970 to create the laboratory of nuclear radiation at the Faculty of Natural Sciences, as an experimental center equipped especially for nuclear work; 1 year later, this center was converted into the Institute of Nuclear Physics at the University of Tirana.

In the 10-year period of 1970-1980, a number of important events took place in the science of physics, just as in our entire science in general, stemming from the far-seeing decisions and guidelines of the party for the development of the technical and scientific revolution, which are formulated in a synthesized manner in the directives of the Seventh Party Congress that "scientific research work and studies be converted into a general method that will penetrate and precede every action and will effectively aid in solving the current and future problems of the building of socialism and the defense of the fatherland."

Now, two main routes of research in physics have been outlined clearly in our country: solid-state physics and applied nuclear physics, directed mainly by the departments of physics of the university and by the Institute of Nuclear Physics attached to the Academy of Sciences. A great number of groups of physicists and specialists in other fields, working in the enterprises and institutions everywhere in the fatherland, are collaborating with these two main centers.

Recently, a center for electronic microscopy has been set up at the Faculty of Natural Sciences and has put an effective means of research work in the service of solid-state physics and of the other branches of science.

In the field of solid-state physics, the departments of physics have achieved results of important practical values such as the perfection of the method for the extraction of selenium of high purity and the production of semiconductor plates. They have studied the characteristics and the possible use of Tropoje quartz in the formation of silicium and of ferrosilicium in cooperation with the Institute of Mechanical Studies and Designs; they have enlarged and expanded their research work and have managed to construct a pilot-plant for the production of technical silicium; and have terminated the study of the physical, chemical and technological characteristics of silicium-bearing raw materials with valuable data for the glass industry.

Also, in the field of solid state physics, the departments of physics have studied the mechanical-physical characteristics of copper of our country and the problems of the structure of the formation by stages of metals and alloys, the presence of internal pressure, the textures and so forth, using X-ray structural analysis and microscopic-electronic analysis and the problem of the possibility of producing, in the country, carbographite materials of interest to the printing industry and transportation. They have also examined other problems of applied physics such as the use of ultrasound, especially in biological and agricultural sciences and the elimination of negative phenomena of static electricity in the textile and paper industries and so forth. They have carried out an important work in methodical and scientific studies such as these which are linked with the improvement of the effectiveness of the teaching and scientific processes through audio-visual techniques and so forth.

In the field of theoretical physics, the departments of physics have carried out and are carrying out works such as: the explanation of many phenomena in crystalline liquids and the molecular crystals of the ellipsoidal glass condition, the study of specimens in the electric and magnetic fields on strata of

petroleum and gas, the study of the use of the theory of groups in some problems of the theory of the field, the study of the problem of determinism in quantum mechanics and the evolution of views on the structure of matter and so forth.

Now that the center of gravity of the research work in the field of nuclear physics has been moved to the Institute of Nuclear Physics of the Academy of Sciences, the departments of physics are continuing their collaboration with the institute and are working on some aspects such as the monitoring of the radioactivity of the atmosphere through the timed distribution of global beta activity in the atmospheric precipitations and deposits, and the study of radioactivity of mineral waters.

In the field of nuclear physics, during the 10 years of activity of the institute, some noticeable results were achieved in regard to putting the methods of nuclear physics in the service of our economy and science. Thus, isotopic trackers were widely used in industry for checking the drilling columns in oil wells; in agriculture, for checking the process of fertilizing and of rational microfertilizing; and, in hydrology, for the measurements of debits, filtrations and movements of subterranean and surface waters, as well as of the dynamics of the movement of sediments in port construction. In the sector of medicine, the compositions indicated for diagnosis were used, perfecting work methods and techniques such as radioimmunoassay and scintigraphy.

Studies have been done on the mutagenic effects of gamma radiation on the kinds of plants which are of interest for our country. With the participation of or under the direction of the research institutions and the agricultural experimentation centers, radiation has been used in small quantities for the stimulation of seeds before sowing and data have been obtained about the quantities which are most favorable for preventing the sprouting and spoiling of agricultural products, such as potatoes, onions and so forth.

Durin$_{o}$ the study of the effect of radiation, conclusions of practical value have been obtained on the improvement of the physical characteristics of polyethylene through electronic radiation.

The development of analytical methods and techniques holds an important place in the scientific activity of the institute. In this field, we can mention the development of such things as the spectrometry of gamma rays and X-rays, mass-spectrometry, the recording of low levels of radiation, the problems of the joint action between radiation and substance, digital methods of processing spectra and so forth.

Now, the institute is working extensively on neutronic activation, with rapid and thermal neutrons, using isotopic sources and neutron generators; the method of X-ray fluorescence with semiconductor detectors has been successfully put into operation. The institute has put the method of determining the absolute age of rocks (K-Ar method) in the service of geology, has used scintillators and fluids in radiometry and has assimilated the method of attenuating isotopes.

In harmony with the development of experimentation in physics, now a relatively good level has been assured in the field of nuclear electronics so as to handle only the incorporation of contemporary electronic technology using highly integrated circuits but, also, to design in the country nuclear apparatuses for measuring and controlling, such as level and density measures for melting in closed containers, radiometers of simple types of gamma ray detectors.

The Eighth Plenum of the Central Committee of the Albanian Workers Party and the Seventh Five-Year Plan open new prospects for and mark a new step on the road to the quantitative improvement of physics in our country. Thus, the rapid development of industry, especially of the mineral processing, metallurgical and machine industries, assigns to solid-state physics the task of making a qualitative leap forward in the field of experimentation and of theoretical generalization. A further increase in the use of nuclear methods and the invigoration of nuclear electronics are foreseen in the field of nuclear physics. Other new elements are the tasks for the development of laser technology in the service of the economy and defense. Also, there are plans to develop biophysics in our country. Neutron physics, as one of the most important branches of nuclear physics, will progress on the road of its invigoration and stabilization, on its own direction, until the construction of the experimental reactor.

It is the task of all our physicists, justifying the confidence bestowed on them by the people and the party, to elevate the physical sciences to an increasingly greater level and make of them an effective means for the development of the other theoretical and applied sciences in our country.

As all our workers, our physicists, too, are looking forward to meeting the 40th anniversary of the founding of the Albanian Workers Party and the Eighth Party Congress with new successes. Even greater are the tasks undertaken by our physicists, for the future, for the further development of the physical sciences and for the expansion of the technical and scientific revolution in our country.

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PROBLEMS OF DISCRIMINATION IN REGIONAL ANALYSIS

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[Article by Guillaume J. Wunsch, professor at the Demography Department of Louvain University]

[Text] Discriminational Analysis

Let us consider n number of regions, characterized by a dependent variable (e.g., the estimated value of the rough mortality rate, taken by some standard method) and m number of regions, characterized by independent variables X_1, X_2, ..., X_m (e.g., environmental factors influencing mortality). Let us assume that by an appropriate classification (grouping) process regional subgroups are generated from the n number of regions, based on the affinity of their mortality rates; from these, subgroup A has n_1 regions with a low mortality rate, subgroup B has n_2 regions with an average (i.e., medium) mortality rate, and subgroup C, n_3 regions with a high mortality rate. The regions can, of course, be grouped according to their area characteristics or other indicators, based on their affinity, but the criterion used for the classification is not considered here. This topic is regarded as external to the scope of our study.

The important problem is to establish independent variables from X_m, which best explain the differences between the given subgroups of the regions and play the most significant role in them. A possible approach is to regard the subgroups of the regions as dummy variables (Reference 3, Chapter 6; Reference 9, Chapter 3) and submit the relationship of these variables and the X_i coefficient variables to multiple regression tests. If we have k subgroups, which are all dummy variables, the correlation analysis between the k-number Y value and the m-number X value of the key variables (coefficient variables) is performed using the method of so-called canonical correlation analysis (Reference 1, Chapter 12), which is an extension of the case when there is more than one Y variable.

The problem in question, however, can also be solved by discriminational analysis; in this case, the goal is to find that linear combination of variables X_m which can be optimally differentiated between the subgroups of the regions. Discriminational analysis can be regarded as that extension of factor analysis during which those orthogonal components are chosen which delimit the regions in view of their classification to groups (Reference 2,

Chapter 9); however, it can also be regarded as a multivariate normal population classification procedure, whose variance and covariance matrices are equal (Reference 1, Chapter 6). The orthogonal components are called discriminational functions. The first discriminational function maximizes the value of the variance between the groups, relative to the variance within the groups; one of the consequence of this is that the differences between the groups will be large compared to the differences within the groups. After the first discriminational function is formed, the second one can be formed based on the consideration that the second one must be orthogonal to the first one (same as in factor analysis); the process is continued until the last orthogonal discriminational function is generated: it can be easily seen that k-1 discriminational functions are generated, if the number of regions is k (if $k-1 < m$, m is the number of X variables). To express this more formally (Reference 2, pp 246) let A be the square deviations of the group average and overall average of variables X_m and the matrix containing the sum of their series between the groups; moreover W will indicate the matrix which contains the X_m-variable square deviations from the group average and the sum of their series within the groups. Let υ be the vector of those weights which maximize the proportion of square sums between the groups for the square sums within groups; i.e., when equality $\lambda = \frac{\upsilon' A \upsilon}{\upsilon' W \upsilon}$ is satisfied. It can be shown by differentiation that the maximum value of λ(λ_1 and the connected υ_1 vector of the weights) corresponds to the largest eigen value (and its connected vector) of the characteristic equation $(W^{-1} A - \lambda I)\ \upsilon = 0$, where I is a unit matrix. Using the formal language of vector algebra, the first discriminational function can be expressed as $y = \upsilon_1' x$, where x is the vector of standardized key coefficients (coefficient variables). The second discriminational function can be expressed in form $y = \upsilon_2' x$ and formed after the maximization of λ, taking into account that the second function must be orthogonal to the first one. This process can be continued until the $W^{-1} A$ eigen value becomes zero; if $k-1 < m$, rank A or W^{-1} becomes k-1, i.e., it becomes identical to the rank of matrix A, and thus k-1 number of discriminational functions can be formed from the characteristic vectors of the equation.*

For every discriminational function (standardized discriminational function coefficient), vector υ of the weights indicates the contribution of the individual variables to the value of the functions; the larger they are (independent of their sign), the more discriminating are the connected variables. Based on this, the variables that best "explain" the differences between the groups can be selected. The coefficients generated for the first discriminational function (same as in factor analysis) supply the values of the key variables; the coefficients satisfying the second discriminational function become the key variables after the "contribution" of the first discriminational function is subtracted.

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* If the number of the groups does not exceed that of the variables ($m \geq k-1$), the maximum number of the discriminational functions is m, i.e., this number becomes equivalent to the number of variables.

Let us assume that there are new observational results available for variable X_m. The second task of the discrimination, in this case, is the classification of the observational results to the most appropriate group. Classification "marks" can be generated (computed) for each group; the new observational data is relative to the group with the highest "mark," i.e., the group at the shortest distance from the observation. If the variables are correlated (collinear), it is advisable to use the Mahalanobis distance index (Reference 7, Chapter 18), since it is better than the Pythagoras distance index. The Mahalanobis square distance between vectors x_i and x_j can be determined by the $(x_i - x_j)' - (x_i - x_j)$ formula, where Σ is the variance - covariance matrix of the complete set of variables.* The Mahalanobis distance index is used throughout this treatise.**

Aggregation and Multicollinearity

Interdependent variables are called multicollinear. As we know, in econometrics, multicollinearity influences the accuracy of results generated by regression analysis: the true significance (explanatory power) of original variables remains hidden if they are strongly interrelated. One of the objectives of this study is the discovery of the effect of multicollinearity between key variables (coefficient variables) in discriminational analysis.

The second objective of our study is to shed light on the effect of aggregation on the discriminatory power of X_m variables. As we know, aggregation may become in some cases a source of "ecological errors" in regression analysis, since aggregation not only results in a significant increase in correlational connections but--in the case of contextual and ecological effects--can also hide the most significant relations (e.g., see Reference 6, pp 190-193).

The effect of aggregation and multicollinearity on discriminational analysis results will be examined with the aid of simulation. Let us consider a random number of administrative regional units (e.g., 56 of them) for which the analytical correlation of X_m variables is fully known. The 56 units (subregions) are grouped to 8 larger units via systematical or random classification. We may start with our previous example: the subregions may, for instance, be classified based on their mortality rate; discriminational analysis involves the X_m key variable (coefficient variable).

The 56 subregions are then grouped to 8 regions (systematically or randomly) and discriminational analysis is extended to these larger units (regions), after grouping them according to the average mortality rate in the given

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* Other distance indexes are used as well, but, in general, the use of the Mahalanobis index is recommended (see Reference 4, pp 131-163).

**The Mahalanobis distance criterion can also be formed by computing the logarithm of the likelihood portion of the normal case and making it equal to one. See Reference 7, pp 260-261.

regions. Then the results of analysis based on the grouped data are compared to those based on the original (ungrouped) data.

The discriminational analysis program was generated based on version H of the SPSS program package (Reference 5, Chapter 23) and the stepwise selective and stepped Mahalanobis distance criterion was used. To check the results, another, the Rao generalized distance criterion* was used and the results were found to be very close to those obtained by the SPSS program package (except for one, which will be discussed later).

Model A: Perfect Multicollinearity

The model is based on the following relationship:

$$Y = X_1 + 20 \qquad X_1 \text{ varies between } 1 - 56$$
$$X_2 = 10\ X_1$$
$$X_3 = 57 - X_1$$

The three key coefficients (X_1, X_2 and X_3) are linearly related. The 56 subregions are grouped in two classes. Classification to model AA is systematical: 28 low-value subregions end up in region A, and the remaining 28 in B. Classification to model B is random.

Models AC and AD are based on regions: the 56 subregions were grouped systematically and randomly to 8 regions. In models AC, the grouping of subregions was based on the values of variable Y; after that, the eight regions were divided into two parts based on variable Y, i.e., they were grouped to class A and B: the values of variable Y and X_m are generated according to the data in Table 1.

Table 1. Average Values of Variables by Regions (AC Model)

Class	Region	Y	X_1	X_2	X_3
A	A1	24	4	40	53
	A2	31	11	110	46
	A3	38	18	180	39
	A4	45	25	250	32
B	B1	52	32	320	25
	B2	58	38	380	19
	B3	65	45	450	12
	B4	73	53	530	4

In the case of model AD, the grouping of the subregions to two classes was done randomly. Thus the classification is identical to the procedure used during the two-step sampling procedures: based on a different random classification different results are obtained. The average values relative to the eight regions are formed according to the data in Table 2.

*This program may be found in the statistical package of the North Carolina State University.

Table 2. Average Values of Variables by Regions (AD Model)

Class	Region*	Y	x_1	x_2	x_3
A	A1 (4)	55,5	35,5	355	21,5
	A2 (12)	42,3	22,3	223	34,7
	A3 (5)	42,8	22,8	228	34,2
	A4 (9)	60,9	40,9	409	16,1
B	B1 (8)	42,9	22,9	229	34,1
	B2 (7)	38,9	18,9	189	38,1
	B3 (2)	53,5	33,5	335	23,5
	B4 (9)	45,7	25,7	257	31,3

* The number enclosed in parentheses indicate the number of subgroups (subregions).

Unlike in regression analysis, during which perfect multicollinearity renders the inversion of the X'X matrix of the key coefficients (coefficient variables) impossible, it is possible to compute the orthogonal discriminational functions in this case. The application of the stepwise Mahalanobis criterion in the case of model AA results in the selection of only one (X_2) key coefficient (coefficient variable) by a nearly perfect discrimination between the subregions. This same process makes possible the discovery of a key variable (the X_3 coefficient variable) in model AB which is based on the random classification of the subregions; the discrimination, however, in this case is very weak; the value of the canonical correlation coefficient of the discriminational function and the coded class variable of the dummy variable is only 0.19 (and statistically is not different from zero, P = 0.05).

If we consider aggregated regions, however, in model AC, X_2 is the only key variable (coefficient variable) (the value of canonical correlation coefficient is 0.998) and no variable is selected in model AD based on random classification. Thus, the stepwise Mahalanobis criterion takes into account the fact of multicollinearity and selects only one key variable (coefficient variable); furthermore, the random nature of the classification was also demonstrated, and thus the application of the method offers the opportunity to avoid erroneous conclusions.

Model B: Imperfect Collinearity

In model A, the data were randomly obscured by the generated "white noise" in order to get rid of the perfect multicollinearity between variables X_m.* At the same time, the collinearity between the key variables (coefficient variables) remained strong (0.98, or higher).

Model BA resembles model AA in certain ways: the classification of 56 subregions to 2 classes is based on their Y variables. When the stepwise procedure is used, only one variable (X_3) is selected, and the value of the canonical correlation coefficient is 0.855, i.e., 14 percent less than in model AA

*This is not the case if the so-called direct method of the SPSS program is used: based on this criterion, two perfect collinear variables are selected. Thus, it is simpler to apply the stepwise Mahalanobis distance criterion.

because of the white noise. In spite of this high discriminational level, the classification of the original variables is done with rather poor results: from 56 subregions, 25 are incorrectly classified! Using the same data, the SAS program classifies only 3 subregions incorrectly out of 56; classification marks were calculated for all 56 subregions, and this approach was used for the classification of original data. Using this procedure, only one subregion was incorrectly classified; thus it appears that the application of the SPSS program (based on the probability of the grouping) produces faulty results in certain situations, such as the one mentioned.

In model BB, the 56 subregions were randomly divided between the 2 classes. No variable was selected that could have been regarded as a discriminational variable between the two classes.

Models BC and BD are based on the repeated aggregation of the subregions. In the case of model BC both aggregation and classification are systematical, the same as in model AC. In the case of model BD (as in model AD) both aggregation and classification were randomly performed. In the case of model BC, two variables (X_1 and X_2) with approximately equal discriminational power were selected, in spite of the significant multicollinearity between the X_m variables. The value of the canonical coefficient increased from 0.855 (model BA) to 0.937 (model BC) as a result of aggregation. Fortunately, in the case of random model BD, no variable was selected.

Model C: Random Data

In this model, all X_m variables were randomly generated. The classification and aggregation of subregions were also randomly performed. In the case of model CA (all 56 subregions), variable X_3 was selected as a key variable; the discriminational force, however, is almost negligible (the value of canonical correlation coefficient is 0.14 and statistically is not different from zero, $P = 0.05$). In the case of model CB (8 regions), the stepwise operation did not select any variable. Once again, it has been demonstrated that no significant discriminational variables can be obtained by random classification.

Model D: Contextual Effects

Contextual and ecological effects were also introduced to this model. Data were selected for 56 regions (divided into 8 groups) in a manner to render the relationships between the variables contrary to the connections between the groups. Figure 1 shows as an illustration the connection between the Y dependent variable and the X_3 independent variable in this case.

The 55 subregions were grouped to 2 classes: for model DAA, the grouping was random and for model DAB, systematical; the 28 values of variable Y were assigned to class A and its 28 highest values, to class B. In the case of random classification (model DAA), the stepwise Mehalanobis criterion did not result in the selection of any variables. In the case of model DAB, variable X_3 was the only discriminational variable; the canonical correlational coefficient was equal to 0.855. During the reclassification process, the application of the SPSS program package again produced faulty results (as in the

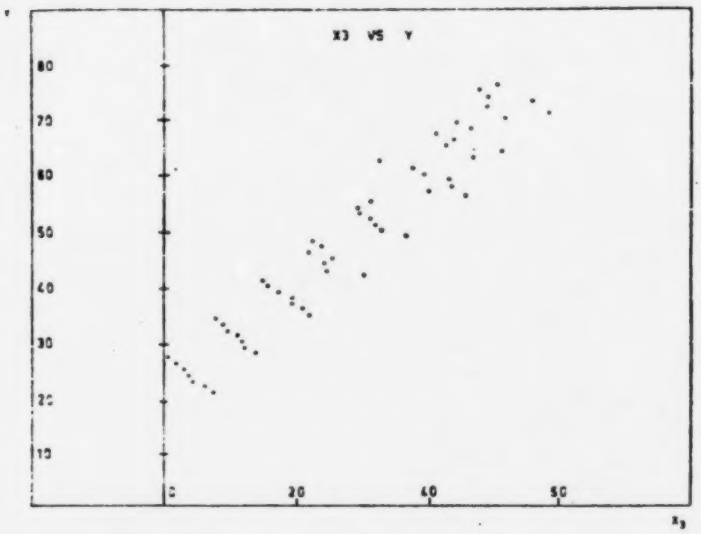

Figure 1. Relationship Between Y and X_2 (original data)

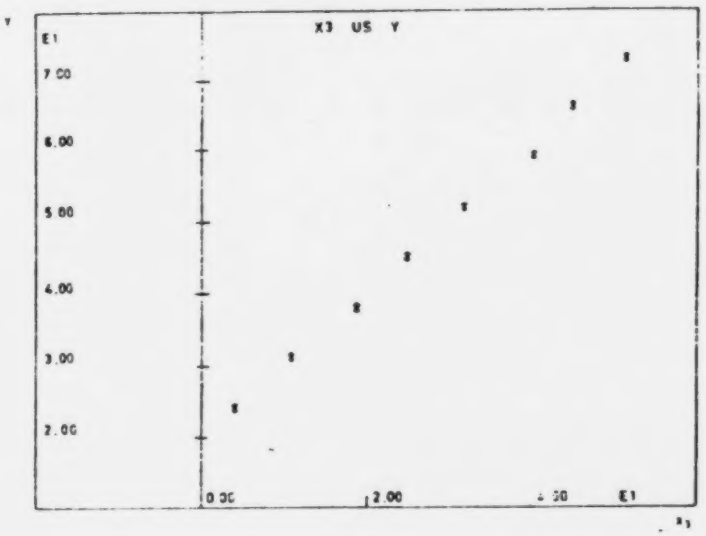

Figure 2. Relationship Between Y and X_3 (Aggregated Data)

case of model BA), instead of 28 subregions only 7 were assigned to class B. If the subregions are classified according to their class "marks" instead of their group association likelihood, only one subregion will be incorrectly classified. Thus, the conversion of class "marks" to group association probability is not allowed.

Model DB groups the 56 subregions to 8 regions which correspond to the 8 groups of model DA. Aggregation, in this case, results in the obscuring (hiding) of the relationship between the groups: as shown in Figure 2, only the connection (contextual effect) between the groups is visible following aggregation. In the case of model DAA, the classification is random; no discriminational variable is chosen. At the same time, systematical classification was used for model DAB; this brought about the selection of two discriminational variables (X_1 and X_2). It is interesting that during stepwise approximation (i.e., after the first step of the process), variable X_3 appeared to be the most discriminational; after the introduction of X_1 and X_2, however, the discriminational power of X_3 dropped drastically until variable X_3 disappeared (was struck) from the list of discriminational variables. The occurrence of this case is especially typical when the collinearity between the variables is very large, which results in the appearance of extraneous variables. In the current case, variables X_3 and X_2 are collinear to X_1, and thus discriminational analysis selects one more variable than necessary. The discrimination is excellent; the value of the canonical coefficient is equal to 0.934, and the classification of all occurring cases is proper. Thus, it is once again demonstrated that aggregation leads to the increasing of the canonical correlation coefficient, since this latter was a mere 0.855 for ungrouped data (model DAB).

Conclusions

The purpose of this study was to disclose the effect of data aggregation and that of multicollinearity between the variables on discriminational analysis. It has been demonstrated that aggregation leads to the increasing of the canonical correlation coefficient, as it increases the multicorrelational (i.e., determinant) coefficient value in multiple regression analysis. Thus high values of this coefficient do not always guarantee good discrimination. For that reason, this coefficient must be submitted in all cases to significance examination. Discriminational analysis never falls into the loophole of random classifications. The incorrect selection of the discriminational variable from randomly classified data does not occur either; either in the case of previously aggregated or for ungrouped data.

The elimination of extraneous variables resulting from multicollinearity can be rather well managed by the application of the Mahalanobis criterion. The discriminational variable still varies from model to model: thus the disclosure of fundamental connections cannot be regarded as appropriate (satisfactory).

In closing, it will be noted that the reclassification procedure of our data via the application of the SPSS program brought to our attention some problems: postclassification based on the classification "marks" produced better results than the classification procedure based on the likelihood of group association did.

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TUNABLE DYE LASERS AND THEIR APPLICATIONS

Debrecen LUMINESZENCIA in Hungarian 27-28 Aug 79 pp 21-45

[Article by B. Racz, Zs. Bor and L. Kozma, Attila Jozsef Science University, Experimental Institute, Szeged]

[Text] The close relationship between laser physics and luminescence research provides a good basis to summarize the functioning and typical applications of a special class of lasers, dye lasers. An ideal excitation light source for spectroscopic purposes would have sufficient power; a small bandwidth compared to the examined phenomenon would be well-directed (i.e., easy to handle from the optical viewpoint), suitable for the generation of short optical signals; and its wavelength could, if necessary, be easily changed. To complete the requirements, this light source should be inexpensive, if possible, and technically easy to handle.

Unfortunately, such a light source does not exist. If we limit our interest to the visible and near ultraviolet spectral range, dye lasers are a good approximation. Accordingly, dye lasers are extremely widespread and are used in a multitude of applications.

I. Functional Basis of Dye Lasers

By dye we mean those organic materials that contain chromophore groups and have strong absorption in the near ultraviolet, visible and infrared range. The chromophore group is a conjugated chain of carbon atoms with alternating single and double bonds. The longer the chain is, the larger the absorption wavelength. Only those materials can be considered lasers that, following absorption, return to their basic state via light emission; i.e., are fluorescent. As a result, of the several thousand dyes known, only about 500 can be used as an active agent of dye lasers.

The thermosystem of a typical dye can be seen in Figure 1. S_0, S_1, S_2 indicate single, and T_1, T_2 triple electron states. Resonance sublevels are indicated by thick lines, the expansion caused by the interaction with the solvent by thin lines, optical transition by continuous lines, and nonoptical by dotted lines. In the case of thermal equilibrium, the molecules are in state S_0 and distributed in the resonance sublevel according to the Boltzmann distribution. As a result of optical excitation, $S_0 \rightarrow S_1$, $S_0 \rightarrow S_2$ transitions

are produced as a function of the wavelength. Without $S_2 \rightarrow S_1$ transition radiation, S_2 lasts for 10^{-12} seconds (s). Fluorescence is created by the allowed transition, which typically lasts for 3.10^{-9} s. The equilibrium distribution in the resonance sublevel appears in about 10^{-12} s; thus the fluorescence spectrum is independent of the excitation wavelength. The dye laser operates between levels $S_1 \rightarrow S_0$.

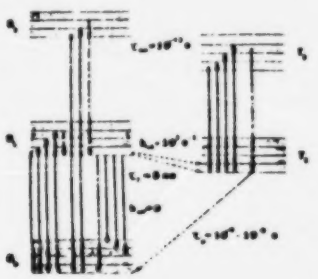

Figure 1. The Jablonsky Thermal System of Dyes

Although transition $S_1 \rightarrow T_1$ is illegal, its transitional probability is 10^7 s^{-1}. T lasts for 10^{-6} - 10^{-3} s; i.e., in the case of excitation longer than 10^{-6} s, T_1 may become well filled. Transition $T_1 \rightarrow T_2$ is also permissible and normally falls within the expected wavelength of the laser. Absorption $T_1 \rightarrow T_2$ may be a source of significant losses in the case of dye lasers generating pulses longer than 1 μs.

Let us examine closer the conditions for the appearance of optical amplification. Let a light beam of intensity I and frequency ν fall on a homogeneous material. Passing through a layer of thickness dx, its intensivity change can be expressed by the following form:

$$dI = -k(\nu)Idx \tag{1}$$

where $k(\nu)$ is the absorption coefficient of the material, which of course, depends on frequency. It is useful to transcribe $k(\nu)$ - t to $k(\nu) = N\sigma_a(\nu)$ for the dye molecules, where N is the concentration of the molecules and $\sigma_a(\nu)$ the absorption efficiency cross section. From the excited state, part of the molecules transits to the basic state via fluorescence, i.e., via spontaneous emission. This, however, is distributed over a 4Π solid angle; thus, its effect on the intensity of excitation beam I is negligible. Forced emission is much more important, since its frequency, phase, polarization and propagation direction agree with those of the excitation radiation. Taking into account forced emission, equation 1 can be expressed in the following form:

$$dI = -Idx[N_0\alpha_a(\nu) - N_1\alpha_e(\nu)] \tag{2}$$

where N_0 and N_1 are the concentration of the molecules in the basic and excited states and $\sigma_e(\nu)$ is the efficiency section of the forced emission.

The magnitude of the efficiency cross section $\sigma_e(\nu)$ is similar to that of the absorption efficiency cross section and falls in the fluorescence spectrum. Comparing equation 1 with 2, we set the following equation:

$$(\nu) = N_0\sigma_a(\nu) - N_1\sigma_e(\nu) \tag{3}$$

In the equilibrium state, $N_1 << N_0$ and thus $k(\nu)$ are positive; i.e., the material has absorption. Through sufficiently intense excitation, a significant percentage of the molecules may enter the excited state; quantity $k(\nu)$ can assume negative values in the fluorescence spectrum. From the physics viewpoint, negative absorption means amplification. To summarize, the dye solution becomes an optical amplifier through the effect of sufficiently intense excitation.

Let us examine next the behavior of a dye solution having optical amplification in a so-called resonator, which consists of two parallel flat mirrors with reflection R_1 and R_2. The amplification of the dye solution is characterized by the $\alpha(\nu)$ amplification coefficient, which is defined as -1 times the absorption coefficient. After passing through the dye solution, which has wavelength L, the I initial-intensity light has intensity $I\exp\alpha L$ (Figure 2). It is reflected from the mirror of reflection R_1 with $R_1I\exp\alpha L$ and passes through the solution again, exiting with intensity $R_1I\exp 2\alpha L$. It is finally reflected with $R_2R_1I\exp 2\alpha L$ from the mirror of reflection R_2. Condition $I=R_2R_1I\exp 2\alpha L$ must be satisfied in order to ensure that the intensity within the cavity is not reduced.

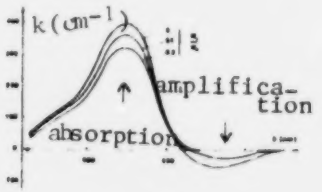

Figure 2. The Function of Absorption Wavelength in the Case of Various Excited State Population. Negative absorption is equivalent to optical amplification.

Forming the logarithm of the equation, the following expression results:

$$\alpha = \frac{1}{2L} \ln \frac{1}{R_1R_2} \tag{4}$$

which is the condition for the self-excitation of the laser. If the amplification of the dye solution in the resonator exceeds the value defined by the four expressions, the setup will function as a laser.

II. The Structure of Dye Lasers

The excitation of dye lasers may be accomplished by another pulse-driven laser, flash tube or continuous operation laser. The structures of variously excited lasers differ from one another; thus, it is best to discuss them separately.

II. 1. Dye Lasers Excited by Pulse Lasers

Pulse lasers generate 10 kW to 10 MW pulses for 1 to 50 ns. If power of this magnitude is focused on a 1 cm x 0.3 mm line, the $\alpha(\nu)$ amplification factor may reach a value of 1 to 10^{-1} cm, and the condition of self-excitation[4] can be easily satisfied. Excitation by nitrogen laser will be demonstrated next, since this is the most commonly used method; the observations are valid for other cases as well.

The nitrogen laser radiates a light pulse at 337.1 nm in the near ultraviolet range, with a power of 0.1 to 3 MW for a period of 5 to 10 ns and a repetition frequency of 0 to 500 Hz. Its technical simplicity and relative cheapness are the real reasons for its popularity.

There are several methods for the experimental arrangement of dye lasers; the so-called transversal arrangement will be discussed here. The beam of nitrogen lasers is focused by a cylindrical lense on a 1 x 1 cm transparent cuvette. The concentration of dye solution in the cuvette is chosen to have a 30^{-1} cm absorption coefficient at the wavelength of the excitation. This way, an 0.3 mm x 0.3 mm x 10 mm amplifier medium is created. To create a laser with a less than 10 nm bandwidth, the resonator loss somehow must be made a function of the frequency. In the simplest method one of the usual resonator mirrors must be transformed into a reflection grid, as shown in Figure 4. Such laser resembles a Littrow monochromator.

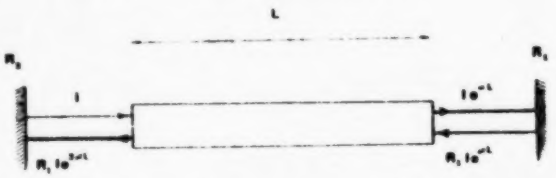

Figure 3. Power Flow Relationships in the Resonator of the Laser.

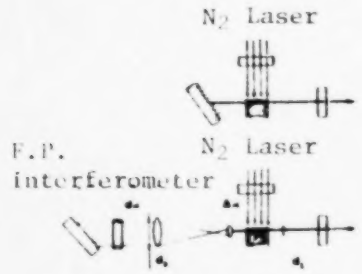

Figure 4. The structure of a Tunable Dye Laser Excited by Laser N_2. Tuning is accomplished via rotating the grid.

Bandwidth can be further reduced in the arrangement shown in Figure 4 by placing a telescope between the cuvette and the grid. If the angle magnification of the telescope is N, the bandwidth is reduced by 1/N.

The frequency dependence in the resonator can be further increased by placing a Fabry-Perot interferometer between the telescope and the grid (Figure 4b). With careful design, in the setup shown in Figure 3b, the Fourier transformation

limit may be approximated, which is expressed as $\Delta t \cdot \Delta \nu \approx 1$, where Δt is the time span of the pulse and $\Delta \nu$ the bandwidth of the frequency. Assuming t = 10 ns, the attainable bandwidth is 10 MHz. Most significant radiation data of dye lasers excited by pulse lasers follow:

efficiency relative to excitation energy: 5 to 25 percent
divergence: 1 to 5 mrad
bandwidth: 0.0005 to 10 nm
tunable range: 350 to 1100 nm
output pulse power: 10 to 200 kW
pulse duration: 4 to 7 ns

According to our latest research, tunable 10^{-10}- 10^{-11} s pulses can also be generated by due lasers excited by N_2 lasers in a special setup.

II. 2. Dye Lasers Excited by Flashtubes

Excitation by lasers can be rather efficient, as high as 25 percent, but exciter lasers have inherently low efficiency. Thus, the resulting efficiency is low. Flashtubes converting electric energy into light with about 30 percent efficiency serve as an improvement in efficiency. They radiate between the ultraviolet and infrared spectrum; the wide absorption band of the dye uses part of the radiation. The light pulse of flashtubes is generally between 1ms to 100 μs; in this case the loss-causing effect of the triple states is no longer negligible. Laser operation longer than 1 μs can hardly be expected if the τ_T decrease is not handled. For this reason, a short pulse-duration flashtube must be used for excitation; this is best achieved by increasing the voltage and the resonance frequency of the whole supply circuit. In practice, there are two popular excitation methods: In one case, a linear flashtube is used in an elliptical reflector; in the other, the flashtube coaxially surrounds the cuvette containing the dye (Figure 5). All methods discussed in the previous chapter can be used for tuning. The efficiency of dye lasers excited by flashtubes can be between 0.5 to 1 percent; output power is much larger than in the case of excitation by a laser. Soviet researchers describe the generation of 400-J power pulses for 10 μs pulse duration. In addition to triple absorption, the ultraviolet and infrared radiation of flashtubes also causes difficulties. One starts a photochemical reaction, while the other heats up the solution, which changes its refractive index. The concentration of active material decreases with the photochemical reactions, while the changing of the refractive index distorts the wave front in the resonator.

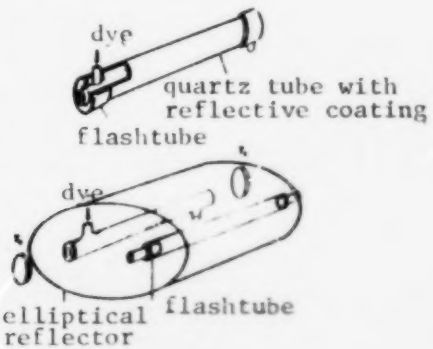

Figure 5. The Structure of a Dye Laser Excited by a Flash Tube.

Parameters of lasers excited by flashtubes are:

efficiency: 0.5 to 1 percent
bandwidth: 10^{-5} to 10nm
power: 10 mJ to 400 mJ
tunable range: 380 to 800 nm
pulse duration: 1 to 10 μs

II. 3. Continuous Operation Dye Lasers

There are two major difficulties in designing continuous operation lasers. First, the power of continuous operation exciter lasers is 1 to 10 W; i.e., 10^3 to 10^6 times smaller than that of pulse lasers. Consequently, it is difficult to satisfy the prerequisites of self-excitation.[4] Second, because of the effect of continuous excitation, the triple state of dyes becomes filled and the $T_1 \rightarrow T_2$ absorption hinders the operation of the laser. These two difficulties can be alleviated by the method in Figure 6.

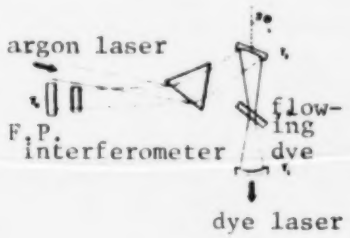

Figure 6. The Structure of a Continuous-Operation Dye Laser.

The beam of the 1 to 10 W average power argon laser is focused by mirror T_2 on the 0.3-mm wide dye solution stream, flowing at approximately 10 m/s speed. The diameter of the focused beam within the liquid stream is about 30 μs; thus the excitation-efficiency density is 10^5 to 10^6 W/cm^2, which produces sufficient amplification. Based on these data, it can easily be seen that the average dye molecule is excited for about 3 μs, after which it exits from the resonator of the laser; its triple absorption does not cause any losses. Thus, the laser has continuous operation, as far as the user is concerned, and pulse operation with a 3-μs pulse length, as far as the molecule is concerned. The prism placed in the resonator and the Fabray-Perot interferometer assure a narrowing of the bandwidth and handle tuning. Typical data of continuous dye lasers are:

efficiency: 10 to 30 percent (relative to the exciter laser)
bandwidth: 100 Hz to 1 GHz
tunable range: 400 to 800 nm

III. Applications of Tunable Dye Lasers

The appearance of tunable dye lasers created a qualitative change in spectroscopy. The sensitivity and resolution of methods increased significantly; the examinable wavelength range became wider. It became possible to study processes shorter than 10^{-12} s. The multifront and nonlinear phenomena during

the application of large excitation densities provide insights to fundamentally new characteristics of the material. Short-duration excited states can also be studied by relatively simple methods. Next we shall demonstrate by examples the new opportunities offered by dye lasers (without striving for completeness) and mention applications important for the economy and other branches of science.

III. 1. Increase in Sensitivity

III. 1. 1. Spectroscopy in a Resonator

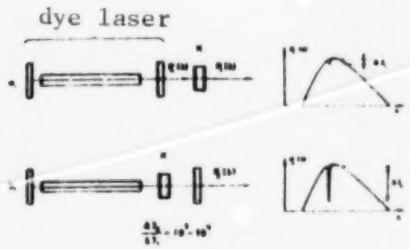

Figure 7. The Principle of Spectroscopy Within a Resonator

The principle of the system is illustrated in Figure 7. Cuvette K, which contains a material possessing weak absorption at a given wavelength, absorbs a small ΔI_1 portion of radiation $P_0(\lambda)$ of the dye laser generating in a wide band. If this same cuvette K is placed between the two mirrors of the laser (i.e., in the resonator of the laser), the spectrum of the laser radiation $P_2(\lambda)$ decreases by ΔI_2 corresponding to the absorption of the material (Figure 7.b). According to the experiments, ratio $\Delta I_2 / \Delta I_1$ (which specifies the sensitivity increase achieved by the absorption measurement in the resonator) can be of magnitude 10^3 to 10^5. The sensitivity increase is caused because the light beam passes through cuvette K several times before exiting from the laser. The laser phenomenon can be accurately understood by solving the differential equation system describing the functioning of the laser. The method is eminently suited for the qualitative and quantitative measurement of very low absorptions.[4]

III. 1. 2. Fluorescence Analysis

The large peak power of pulse-driven dye lasers and the application of phase-sensitivity detection methods improving the signal-to-noise ratio allow determining the extremely sensitive concentration based on fluorescence intensity measurements. For example, in our institute, we can perform reliable measurements of 10^{-12}mol/l dye concentrations by a tuned dye laser excited by an N_2 laser, as an excitation light source. However, there is a real opportunity to increase sensitivity further, since in our experiment the attainable sensitivity was defined by the purity of the chemical agent used.

During the measurement of atomic fluorescence, observations can be made in a narrow spectral range; thus, the signal-to-noise ratio can be improved by an order of magnitude. For example, we have managed to detect a flux of 10 atoms/s in line D_1 of Na by exciting with a continuous dye laser. Under experimental conditions, this corresponds to an Na atom created in laser beam number 10^{-4}.[3]

III. 2. High-Resolution Spectroscopy

Because of the Doppler effect, the absorption and emission frequency of moving particles differ from the transitional frequency of idle particles. During conventional spectroscopic measurements, the spectrum is formed by particles of various speed; thus the spectrum lines widen. The widening is usually much greater than the natural line width. Using tunable dye lasers, we developed several processes suitable for the resolution of the fine structures of the lines "smeared" by the Doppler widening. In the following, we shall describe the principle of so-called saturation spectroscopy.

The method is based on the so-called "hole-burning in Doppler distribution." To understand the system, let us consider a bilevel system struck by an $E \cos(\omega t - kx)$ plane laser wave (Figure 8).

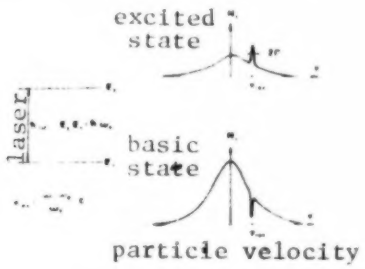

Figure 8. "Hole-Burning in Doppler Distribution."

From this plane wave, only those particles can be absorbed whose velocity, satisfies the following condition:

$$|\omega - \omega_0 + kv_x| \leq \Gamma \qquad (5)$$

where Γ is the homogeneous width of the transition and v_x is the x velocity component of the particle. If the intensity of the laser light is sufficiently large, the distribution of particles satisfying condition 5 changes in such a manner that their concentration in the basic state decreases and in the excited state increases; i.e., saturation is achieved. Thus in the Doppler distribution, the laser beam "burns a hole" in the location corresponding to velocity $v_r = c(\omega-\omega_0)/\omega_0$. The diameter of the hole is determined by the homogeneous width of the line. The laser power necessary for the saturation is usually 10 mW.

Following saturation, the measurement of the homogeneous line width is reduced to the detection of the hole appearing in the population. A number of methods have been developed for this purpose, from which we shall describe the saturation spectroscopic method of an advancing wave. The experimental setup is shown in Figure 9.

Passing through the sample, the beam causing the saturation strikes a semi-translucent mirror, from where a small fraction of the beam--the so-called trial base--is reflected and arrives at the detector after passing through the sample again (Figure 9.a). The intensity of the trial beam is chosen to

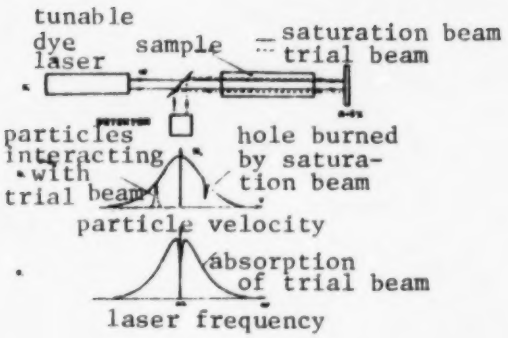

Figure 9. Advancing Wave Spectroscopy

be sufficiently low to ensure that it does not cause any further saturation. Since the direction of the trial beam is opposite to that of the saturation beam, it can only interact with those molecules whose velocity component in the direction of the saturation beam has magnitude v_r (Figure 9.b). If frequency ω of the laser agrees with frequency ω_0 of the transition, the trial beam interacts with those particles whose number in the state has already been reduced by the saturation beam; thus, tuning the dye laser, at frequency ω_0, a minimum quantity appears in the absorption, which corresponds to the homogeneous line width (Figure 9.c).

The advancing wave spectroscopic method is only one example of high-resolution spectroscopic methods in the Doppler line. For those wishing to become more familiar with the subject area, we recommend the monographs 2, 5, 8, 9, 10, 11.

III. 3. Increase in Time Resolution

The time resolution measurement method is a reliable gauge of the scientific potentials of a given epoch. Figure 10 illustrates the development of time resolution. The best resolution is about 0.2 ps; to comprehend fully what this means, it is enough to take into consideration that in 0.2 ps, in vacuum, light covers a mere 60 μ distance. The scientific significance of this type of measurement technology is hard to exaggerate.

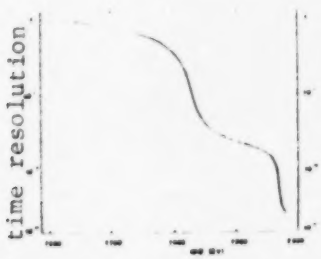

Figure 10. The Development of Time Resolution.

Dye lasers excited by N_2 lasers generate $\tau = (0.5 - 5)10^{-9}$ s duration light pulses. The life expectancy of atomic states and the fluorescence relaxation

time of organic dyes are usually longer than this; for that reason, by measuring the fluorescence decay generated by the dye laser, the life expectancy can be determined. The bandwidth of the available photodetectors, oscilloscopes and counters limit the resolution of these methods to 200 ps.

The appearance of so-called mode-synchronized dye lasers in 1968 caused a qualitative change in the development of time resolution. These lasers usually generate 0.2 to 10 ps long light pulses with 1 to 100 MHz repetition frequency. Since the registration of processes at these speeds cannot be performed at the present by electrical means, optical measurement methods have been developed. Three of these methods will be described.

III. 3. 1. Optical Kerr Gate

Figure 11 shows the setup used for the measurement of fluorescence decay. A Kerr gate is placed in front of the detector, in the path of the luminescence light excited by the picosecond laser pulse train; this gate consists of two

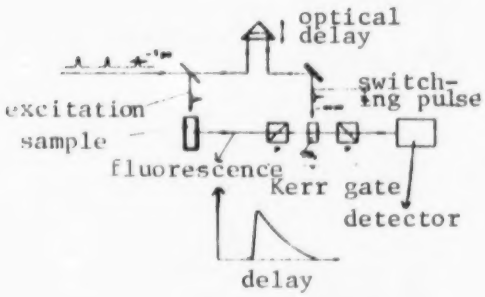

Figure 11. Kerr Gate for the Examination of Fluorescence Decay. The resolution of the setup is 2 ps.

cuvettes containing CS_2 and placed in crosspolarity. The gate lets the fluorescence light through only if the so-called switching laser pulse in the CS_2 causes optical double refraction. Thus, the Kerr gate is an optical lock open only for the time during which the switching pulse is present in the cuvette containing the CS_2. Varying the switching pulse delay, the fluorescence decay can be determined. The principle of the process is similar to the functioning of sampler oscilloscopes.

The length of gating is determined by the length of laser pulse and the relaxation time of the Kerr effect. The time resolution of the method may reach 2 ps.[8]

III. 3. 2. Absorption Saturation Method

Figure 12 shows the setup for the detection of rapid changes occurring in absorption.

From the picosecond pulse train, two collinear beams are formed, which are focused on the sample by the lens. The trial beam--whose intensity is a mere fraction of the exciter beam--serves for the detection of the absorption change caused by the exciter beam. The kinetics of the absorption change can be traced with the delay change of the exciter beam.

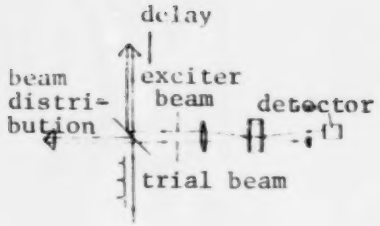

Figure 12. Setup for the Detection of Rapid Absorption Changes. The time resolution may reach 0.2 ps.

III. 3. 3. Transient Induced Grid Method

Figure 13 illustrates the principle of the method. The beam of the laser generating the picosecond pulse train is divided into three parts. From these, two beams generate interference in the sample. The excitation intensity periodically changes in space perpendicular to the direction of interference lines, which changes the complex refraction index of the sample; i.e., it slightly changes its refraction index or its absorption, corresponding to the spatial period of the excitation.

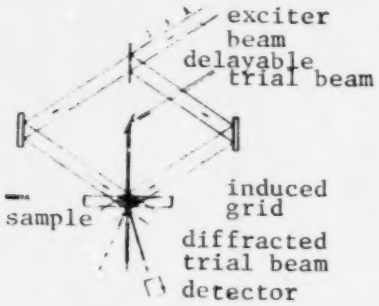

Figure 13. The principle of Transient Induced Grid Used for Measurement of Rapid Processes

This type of structure is called induced amplitude-phase grid. Passing through the sample, the third (the so-called trial) beam suffers diffraction. The intensity of the diffracted beam is proportionate to the modulation magnitude of the spatial refraction index of the induced grid. The relaxation of the induced grid (i.e., the relaxation of the phenomenon creating the amplitude-phase), can be traced with the delay of the trial beam. These three methods are successfully used for the examination of ultrahigh-speed physical, chemical and biological phenomena, such as the behavior of high-density plasma in semiconductors, the diffusion index and life-expectancy measurements of charge carriers and exitons, creation of photons and their relaxation, energy exchange between molecules, rotational relaxation, photodissociation, photochemistry, photosynthesis, oxygen absorption, the role of hemoglobin and rhodopsin in vision, DNA examinations, etc.

We recommend monograph 8 for those wishing to become more familiar with the subject.

III. 4. Application of the High-Power Density of Laser Radiation

By focusing the radiation of pulse-driven dye lasers, 10^9 to 10^{13} W/cm power density can be easily attained. Contrary to the experience of classical optics, the response is nonlinear under the influence of such a large power density. Here we mention only two of the numerous nonlinear effects.

III. 4. 1. Nonlinear Frequency Mixing

Polarization P, created in a medium by the effect of this electrical field strength, is described by the following power series:

$$P = \kappa E + \chi E^2 + \theta E^3 + \cdots \tag{6}$$

where κ, χ and θ are the first-, second-, and third-order dielectric susceptibilities of the material. Field strength is between 0.1 to 10 v/cm in beams used in classicial optics. In this case, the nonlinear members of the power series are negligible, and polarization is a linear function of the field strength. Field strength in laser beams, however, may reach values between 10^6 to 10^8 v/cm, which can be compared with the magnitude of the internal electric field of the crystal lattice. In this case, the high-order members cannot be ignored. Thus, if the medium is struck by an $E = E_0\cos(\omega t-kx)$ harmonic plane wave, the generated polarization wave becomes anharmonic; i.e., it will also contain 2ω-, 3ω-, 4ω-, $\cdots$ frequency Fourier components, which means that a part of the negative frequency is converted to 2ω-, 3ω-, 4ω-, $\cdots$ frequency light. This phenomenon is called upper harmonic generation.

The medium must have strong nonlinearity for effective upper harmonic generation. This requirement is usually satisfied by ferroelectric materials, since polarization shows hysterisis even in the case of a 10^3 to 10^4 v/cm field strength. Hysterisis is an illustrative proof of nonlinearity. Another requirement of effective upper harmonic generation is wave synchronization, which means that the base harmonics of the frequency and the nth upper harmonics of the $N\omega$ frequency propagate at the same speed in the medium; i.e., the refractive index of the medium is identical at its base and upper harmonic wavelength. This requirement is usually not satisfied by the materials because of the dispersion of the refractive index. There are some anisotropic crystals in which, in a given direction, the extraordinary refractive index value at the nth upper harmonic wavelength agrees with the ordinary refractive index value at the basic harmonic wavelength. This direction is called the direction of wave synchronism.

The efficiency of upper harmonic generation may be as high as 10 percent with properly adjusted and high-quality crystals. KDP (KH_2PO_4), ADP ($NH_4H_2PO_4$) and $LiNbO_3$ crystals are used for semiharmonic generation. When nonlinear crystals are struck by laser light of frequency $\omega_1$and ω_2, the generated polarization wave also contains combinational frequencies ($2\omega_1$, $2\omega_2$, $\omega_1 + \omega_2$, $\omega_1 - \omega_2$). In the case of ω_1 and ω_2 components falling in the visible range, frequencies $2\omega_1$, $2\omega_2$, $\omega_1 + \omega_2$ fall in the UV range, while frequencies $\omega_1 - \omega_2$, in the IR range. If the laser radiation of frequency ω_1 or ω_2 is tunable, coherent UV or IR radiation may be produced, thereby facilitating the bandwidth expansion of spectroscopic methods.

III. 4. 2. Nonlinear Absorption; Excited-State Spectroscopy

Lambert-Beer's law (which specifies the exponential weakening of light) is valid when the population change caused by the light is negligible. The intensity of classical light sources is generally insufficient to change the equilibrium population significantly. Under the influence of a laser with as little as 10^5 to 10^6 W/cm power, half the molecules in the organic dye solution enter the excited state; thus, under the influence of beams with this great power, the solution transmission is nonlinear; i.e., it becomes a function of intensity and time. By measuring the nonlinear transmission, the transition probability values between the given levels can be determined. The high excitation power densities produced by the laser allow the direct measurement of absorption from the excited state. Figure 14 shows an experimental setup for this purpose.

One part of the N_2 laser beam produces excited states in the sample; the other pumps the dye laser. To determine the absorption spectrum of the excited state, the weakening of the dye laser beam must be measured twice: once with and once without excitation. The absorption spectrum of the excited states can be determined by tuning the dye laser and performing these two measurements at several wavelengths.[7]

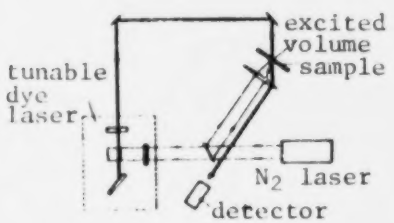

Figure 14. The Measurement Absorption From the Excited State.

In closing, we shall mention two nonspectroscopic applications.

III. 5. 1. Selective Photochemistry, Isotope Separation

With tunable dye lasers, atoms and molecules can be excited at a well-defined rotational and vibrational level of the electrone state; the gas-phase photochemical reactions can be accurately controlled. This offers the opportunity to synthesize pure and fundamentally new compounds. Isotope separation is an important practical branch of selective photochemistry. Below we describe the so-called two-stage ionization method.

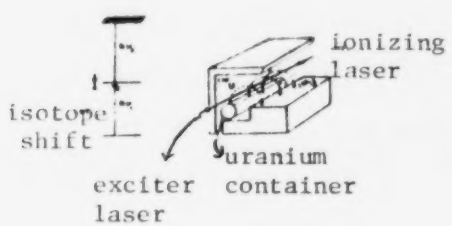

Figure 15. The Principle of Two-Stage Ionisation Isotope Separation

The corresponding isotopes of the atoms in the basic state are excited by a photon with energy $h\nu$, until they reach a state with strong isotope separation and ionize them with a photon of energy $h\nu_2$. This method assures that only one type of the isotope enters the ionized state. Then the ions are collected by an electric field.

To understand the significance of laser isotope separation, it is enough to consider the following: A 100-W average power laser produces approximately 6×10^{23} photons in 1 hour; the efficiency of the photochemical reactions approaches 100 percent; 6×10^{23} uranium atoms weigh 235kg. For those wishing to become more familiar with the chemical applications of lasers, we recommend the monograph 6.

III. 5. 2. Laser Microscope

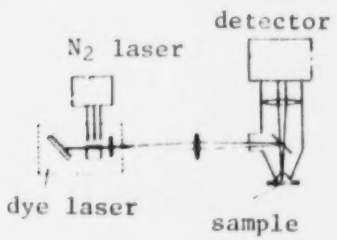

Figure 16. The Structure of a Laser Microscope.

Figure 16 illustrates a laser microscope used for fluorescence measurements. The beam of the tunable dye laser excited by an N_2 laser is focused on a given point of the viewing field of the microscope via suitably positioned optical elements. The fluorescence of the sample is registered by a high-speed light-emitting diode and a sampler oscilloscope. The equipment offers the following advantages:

a) A laser beam can be focused on as small an area as the resolution of the microscope; this permits the excitation of a given section of a cell and the examination of its fluorescence.

b) The excitation spectrum of the fluorescence can be recorded by tuning the dye laser.

c) Life expectancy can be determined by examining the fluorescence decay.

For those wishing to become more familiar with the chemical and biological applications of dye lasers, we recommend monograph 6.

With this, we close our summary, since the treatise calls for only a brief description of a few applications. Nevertheless, we hope that the treatise renders perceptible the qualitative change in optical spectroscopy caused by dye lasers.

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DETERMINATION OF BORON BY PROMPT NEUTRON ACTIVATION

Budapest MAGYAR FIZIKAI FOLYOIRAT in Hungarian Vol 29 No 6, 1981 pp 487-527 manuscript received 4 Aug 80

SZABO, S. ANDRAS, Provincial Food Testing and Chemical Testing Institute, Gyor (author's current affiliation: MEM [Ministry of Agriculture and Food, Main Education and Research Department)

[Abstract] This article is a summary of the author's candidate dissertation. It describes methods used at the Neutron Physics Laboratory of the Joint Nuclear Research Establishment in Dubna. The tests employ the IBR-30 pulse reactor and are based on the $^{10}B(n,\alpha)^{7}Li$ nuclear reaction. The boron concentration is measured with a Si detector having a surface barrier layer, by means of autoradiography, or by means of gamma spectrometry. The test procedures have all been published. The test specimens included ion implanted silicon wafers, metal glasses, biological specimens, and various other materials such as plant samples. The results were evaluated with BESM-4 and BESM-6 computers, using the spectrum devolution method for the determination of the surface boron concentration distribution. The results indicated that the actual measurable boron dose depends on the implantation energy (if the implantation energy is below 80 keV, the true dose is much lower than the dose measured electrically during implantation). Plants take up much more boron than they actually need if the nutrient solution contains more boron and the treatment time is lengthened. The boron is distributed in the plant in a non-uniform manner (maximum boron concentration was found in the leaf tips). The findings demonstrated that the boron moves in plants with the transpiration flow. The prompt neutron activation method is nondestructive and, since the ^{10}B isotope has a high effective cross section, boron can be determined at high sensitivity. Figures 24, tables 16, references 208: 66 Russian, 20 Hungarian, 14 German, 1 Polish, 1 Czechoslovak, 1 Japanese, and 105 Western.

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THE 300 CHANNEL CARRIER-FREQUENCY SYSTEM, TYPE BK-300/N, FOR SYMMETRICAL CABLE LINES

Budapest HIRADASTECHNIKA in Hungarian Vol 32 No 12, 1981 pp 461-468

PORPACZY, ELEMER, graduate electrical engineer, design engineer at TERTA-AFO [Telephone Factory]

[Abstract] The BK-300/N system can transmit 300 telephone channels in the four-wire, separate-frequency mode over a single cable. Each cable strand has a diameter of 0.9 mm, and is made of copper. The cable has an operating capacity of 38.5 nF/km. Transmission takes place through two strands; the other two strands are for service purposes. The line frequency of the system is made up of five main groups in the 312-1548 Hz band. The line-sector devices include the KEK-300/N combination amplifier frame, the NBK-300N remotely supplied and controlled amplifier, and auxiliary devices such as portable power supply and telephone, and crosstalk limiter. Terminal stations are available for the lower and the higher range of the frequency band. Remote supply takes place via the phantom circuit of the carrier-frequency circuits. There may be up to 38 remotely supplied intermediate amplifiers in the remotely controlled sector. The nominal distance between amplifier stations is 1,830 m if a 0.9 mm diameter paper-cordel insulated DM cable is used. Protection against overvoltage and interference is provided. The terminal station and the supervising central station may be supplied with AC from the utility or DC from a central supply. Major subassemblies (KEK-300/N terminal station, VVB-300/N terminator module, VTB line-transformer module, TTE-300/N remote-supply module, HB-4 fault-localizer module, SB-3 service module, LEB-3 branching module, LEB-3 branching module, and NBK-300/N remotely supplied remote-control amplifier) are described and illustrated with wiring diagrams. The system is highly reliable, permits the use of relatively short amplifier fields, allows the utilization of a relatively broad frequency range, and transmits information effectively. There is no need for cable compensation, and the system can be operated together with 12-channel systems operating over the same cable. This article is part of the BHG [Beloiannisz Communications Technological Factory] ORION Terta Reports]. Figures 10, no references.

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HIGHLY COMPLEX THICK-LAYER CIRCUITS WITH MONOLITHIC CIRCUIT CHIPS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 21 No 1, Jan 82 pp 11-13

KOVESI, Andras, Remix Radio-Engineering Enterprise

[Abstract] This article is a report from Remix Radio-Engineering Enterprise. Development of circuits containing noncapsulated solid-state devices made by means of hybrid technology has been an ongoing activity at the enterprise since several years. The use of such circuits reduces the required space, increases the number of available connection points, reduces thermal resistance and improves heat dissipation, and provides economic benefits. The materials used for making these circuits include the paste (fritless gold pastes perform best), additives to reduce paste degradation, and conductor material (such as Heraeus L-HSB gold filament. The gold conductor is printed onto the ceramic substrate first. This is accomplished with a 325 mesh sieve. Then, insulating paste is printed where two or more conductors intersect. After heat treatment, the upper conductor layer, the resistor layers, and the solderable conductor layer are applied, and this is followed by the final heat treatment. The resistors are then adjusted, and the active and passive chips are mounted. The adhesive used to mount the chips is applied by screen printing, using an appropriate mask. Large passive components are mounted with tweezers; the active elements are mounted with mechanical devices, using a modified eutectic soldering device. The adhesive is finally crosslinked at 120°C. Two thermosonic machines are used for making the connections. Appropriate quality-control measures complete the procedures. Figures 3, references 6: 3 Hungarian and 3 Western.

2542
CSO: 2502

MODERN MEASURING TECHNIQUES FOR HYBRID INTEGRATED CIRCUITS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 21 No 1, Jan 82 pp 21-25

KREMER, PETER, graduate computer engineer, Remix Radio-Engineering Enterprise

[Abstract] This article is a report from Remix Radio-Engineering Enterprise. The measuring techniques employed at Remix for quality control of hybrid integrated circuits are described briefly. The aim of the modern testing setup is to ensure that the equipment is easy to operate and convert from one model to another; that the measurements are fast, accurate, reliable, and reproducible; that all circuit parameters of interest are measured at a maximum possible degree of automation; that the results of the measurements are evaluated automatically; that a written protocol is issued on the measurements; and that the measurements are properly adapted to the manufacturing technology employed. Basically, the measurements made are resistance determinations and functional tests. The latter measurements may involve the determination of a variety of values such as voltage, current, frequency, distortion, gain, damping, and switching time. The following measuring systems are briefly illustrated: the Type 685 automatic setter with laser (Z 80 microprocessor, 10 kbyte program memory, 4 kbyte data memory, up to 39 resistors can be set or measured in one cycle (up to 19 if four-point measurements are made), value range 1 ohm to 100 Mohms, accuracy 0.02 percent or 0.05 percent (below 10 ohms and above 10 Mohms, respectively), programmable parameters: initial and final tolerance; location, geometric length, and type of the cut; positioning and cutting speed; laser output, and so forth), Type ATS-A121 analog test system, and PDV-24 programmable digital control unit. Computer-aided processing of the data is a prerequisite; a Siemens PC 100 small computer is used. Figures 11, references 5: 4 Hungarian and 1 German.

2542
CSO: 2502

ANALYSIS OF FACTORS AFFECTING THE CHARACTERISTICS OF NICKEL-CHROMIUM LAYERS

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 21 No 1, Jan 82 pp 7-10

NAGY, ISTVAN, Remix Radio-Engineering Enterprise

[Abstract] This article is a report from Remix Radio-Engineering Enterprise. It discusses the characteristics of NiCr resistor layers made by means of sublimation and the conditions for reproducible manufacture. Uniform temperature of the subliming filament is ensured by stabilizing the current, the voltage, and the length of the filament during sublimation. The composition of the resistor layer obtained is made up from the sublimed NiCr, the residual gas, and the impurities bound by gettering effects. By using a turbomolecular pump, the residual gas can be kept free of hydrocarbons. Reproducibility of the average Ni:Cr ratio of the resistor layer, the NiCr coverage, and the ohms per unit cross section can be ensured if the square resistivity fluctuates between 40 and 200 ohms per square mm. The aging sensitivity of these layers can be maintained within $\pm$2 percent. The reproducibility of the temperature coefficient cannot be achieved to such a close tolerance; the scatter of the values is wider. To obtain information concerning the performance characteristics of the resistor layer, we need information about layer composition, buildup rate, the final crystal structure, aging, and long-term stability. The composition of the pump oil affects the properties of the layer considerably. Figures 7, table 1, reference 1 (Hungarian)

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ELECTRONICS AND ELECTRICAL ENGINEERING HUNGARY

TECHNOLOGICAL ASPECTS OF THE DESIGNING OF THICK-LAYER RESISTANCE NETWORKS

KECSKEMETI, LAJOS, and SZETEI, TIBOR, Remix Radio-Engineering Enterprise

Budapest FINOMMECHANIKA MIKROTECHNIKA in Hungarian Vol 21 No 1, Jan 82
pp 1-6

[Abstract] This article is a report from Remix Radio-Engineering Enterprise. It discusses the factors determining the performance of resistors found in circuits made by means of thick-layer hybrid technology, and a new method for the evaluation of the resistance pastes used. The method of evaluation uses an evaluation board prepared with the RONDEC SCFRI circuit-printing apparatus, accommodated on a 2" by 2" substrate, employing a SOLARTRON Type 7065 microprocessor-based multimeter. The data obtained are processed with a SIEMENS PC 100 benchtop computer. The simple program used provides the mean resistivities, standardized resistivities, scatter, and the modified L/D (shape factor) values. The equipment also features a test-point selector and may be used in conjunction with the appropriate peripheral devices for data storage and further processing according to other considerations. The main goal of the evaluation and processing of the measurement results was to obtain tables and diagrams which can be incorporated in the designing process directly, which contain specific values, and provide maximum possible information of the paste characteristics. It was also expected that the information permits the checking of the settings of the technological parameters. The method provides a data set describing the effects of geometric factors on the characteristics of the paste, so that a regression function adapted to the points is obtained. As a result, it is possible to determine in advance the manner in which a paste from a supplier must be matched to the technological resistance-network manufacturing parameters, and whether the paste conforms to the specifications of the manufacturer and the user. Figures 7, table no references.

2542
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THE TYPE COMBI-X HIGH-CAPACITY TELEPHONE EXCHANGE

Budapest HIRADASTECHNIKA in Hungarian Vol 33 No 2, 1982 pp 73-78

CZOBOR, MIKLOS, graduate electrical engineer, technical and economic advisor of BHG [Beloiannisz Communications Engineering Factory] Development Institute

[Abstract] The COMBI-X high-capacity telephone exchange is still under development. This article, part of BHG ORION TERTA [Telephone Factory] Reports, discusses the services and operation of the exchange. The exchange, as its name indicates, can perform subexchange and main-exchange functions. In terms of system engineering and construction, it is a unit in the AR type telephone exchange family; actually it is a version of the main exchange ARF102 extended for subexchange capabilities. The subexchange sector provides as basic services those which are normally performed by a subexchange, and can be extended for additional such services, without affecting the performance of the exchange as a main exchange. The result is that both secondary subscribers and main stations can be connected. The system uses the MFC signaling method, so that with the postal facilities, which use the same method, even a national network can be set up. Because of the flexible register organization, it can operate in conjunction with other exchanges (for example rotary types) at the group selection level. Since the COMBI-X can be operated as a subexchange (manual operator control), as a centrex exchange (jointly used by several institutions) and main exchange (for main stations), it can handle subscriber and public telephone functions in office buildings used by several instiuturions (both inside and local or long distance conversations), and permits the efficient utilization of the equipment of the telephone central system in peak demand periods. The basic and optional services and operating characteristics of the system are briefly described. Figure 1, no references.

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ELECTRONICS AND ELECTRICAL ENGINEERINC HUNGARY

CONCURRENT PASCAL FOR KERNEL MULTIMICROPROCESSOR

Budapest INFORMACIO ELEKTRONIKA in Hungarian No 1, 1982 pp 3438 manuscript received 17 Jul 81

KACSUK, Peter: GROF, JOZSEF; and HINCS, SANDOR

[Abstract] A microprocessor-based device was recently developed at Videoton for process control. The real-time operating system running on it (multimask monitor) effectively distributes the processor among the concurrent processes, synchronizes concurrent processes with the aid of event variables, and handles the power source via semaphors. Although it performs very effective services, the writing of large concurrent programs is tedious and insufficiently dependable without the use of a high-level programming language. In attempting to select such a language, the CONCURRENT PASCAL was found to be the most suitable. It ensures structured program designing and writing not only for sequential but also for concurrent programs, its monitor concept enables the translator program to check during the translation time the communication of the concurrent processes, and provides the proper method for inherent and divided data structures. To adapt the CONCURRENT PASCAL to the intended purpose, the syntax and the translation method was left intact, only the interpreter and the kernel were modified as required for forming the multimicroprocessor. Figures 3, references 5: 1 Western and 4 Hungarian.

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12 May 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 741

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EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

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POLISH-BRITISH COPRODUCTION OF K-202 MINICOMPUTER ASSESSED

Warsaw INFORMATYKA in Polish No 9-10, Sept-Oct 81 pp 8-17

[Article: "An Assessment of the K-101 Project"]

[Text] 1. Introduction

The K-202 project was discontinued during the first half of the 1971-1980 decade. Because of the time that has elapsed since then, it is very difficult to make an objective assessment. To overcome this difficulty and to present the most realistic picture possible of this project, the group developed this report primarily on the basis of authentic documents from the 1970-1974 period and a discussion with Eng (master's degree holder) Jacek Karpinski on 22 May 1981.

Based on extensive analyses, the characteristics of the project are presented and the technical, organizational and economic-commercial aspects of the K-202 are examined for their interrelationships. This report is a synthesis of documents provided by institutions and individuals. The synthesis takes into account the realities of the first half of the previous decade. The documents cited and referred to in this report are listed in the attached List of Documents. Other items are presented separately [56]. The documents referred to or cited in the report contain data and are signed.

2. Characteristics of the K-202 Project

2.1 The Initial Phase--1970

On 26 March 1970, Karpinski presented a draft of collaboration with the English firms Data-Loop Ltd and MB Metals [1]. The object of collaboration was supposed to be the K-202 digital computer--a universal modular minicomputer using modern integrated circuits.[1]

A diary containing the proposal was sent to:
--Minister Prof Dr J. Jasicki, vice chairman of the KNiT [Committee for Science and Technology];

---

1. The term "minicomputer" is used most frequently in the documents.

--Eng (master's degree holder) R. Farfal of the PZPR Central Committee;
--Eng (master's degree holder) J. Huk, chief director of the MERA [Automation and Measuring Apparatus Association].

Collaboration with the English firms would involve the sale and service of a digital computer--a modular minicomputer called the K-202. The characterisitcs of this machine were presented in brief, the extent of its applications were cited and the participation of both sides in the realization of the venture, its schedule of completion and the distribution of the production (40 percent to Poland for its own needs on the basis of nonforeign-exchange coproduction, and 60 percent to the English firms) were also presented. All the above problems are presented in a diary in a catchy way. The diary states that Eng J. Karpinski is the designer and that the computer can operate jointly with computers then produced in Poland (the ODRA 1304 and the R-30).

On 4 April 1970, D.H. Lord, director of Data Loop Ltd, wrote a letter of intention to the director of MERA regarding a proposal for collaboration among Data Loop Ltd, MB Metals Ltd and MERA to produce small, modern computers [2]. In this letter, it was stated that Karpinski concluded a contract with Data Loop as a consultant for the design of a new small computer and its software that this project would be considered to be the propoerty of Data Loop, that the first model of the computer to be developed and its software were partially complete, and that the project was scheduled for completion by the end of October 1970.

In this letter, Lord also states that Data Loop has complete confidence in Karpinski and that he must be the leader of this project in all its technical aspects, from the model stage to the production stage and from system testing and software development, and that the organizational arrangement for collaboration must satisfy Karpinski. Then Lord stated that further work on a model and the production of two prototypes should be organized within Poland with the production assistance of MB Metals. The components for the model, prototypes and future production will be sent directly to Poland by MB Metals, and in return the MERA will deliver three complete and pretested systems for each of four complete sets of components it receives (25 percent for Poland, 75 percent for the English firm).

On 4 October 1970, an agreement was signed between MERA and Data Loop Ltd (MB Metals Ltd) concerning the development and production of digital computers. The agreement defines the object of collaboration (work on the development of a model and prototypes and the preparation for production of small modern electronic digital computers for "complementation purposes" as well as for exportation), the schedule for realizing the project (the model--October, 1970; the two prototypes--February, 1971), the volume of production (up to 1973 exclusively), the obligations of both sides, the division of labor to develop software (the English would deliver by the end of October, 1970 the preliminary operating system with a symbolic language translator and library of basic functions, and by the end of April, 1971 a FORTRAN translator; in turn, Poland would supply by the end of April, 1971 an ALGOL translator and a library of standard subroutines); the agreement also specified that Karpinski would lead the development team. This agreement contains a clause

stating that Data Loop is obligated to create credit for the purchase of necessary equipment and apparatus needed to produce the model and prototypes. This credit was to be repayed by cash on terms to be arranged. The subsequent stage of collaboration was also specified (after the successful completion of the first stage).

On 30 June 1970, Huk, chief director of MERA, issued official order No 16/Pfn/70 regarding the initiation of production of the minicomputer at the ERA plants as a priority task for MERA. This order specified that the director of the ERA plants:
--create a development-production section for computers;
--present (by 16 July 1970) a detailed schedule for developing and producing a model and prototypes and make preparation for production by the second half of 1971;
--coordinate design principles with Data Loop (by 15 August 1970);
--conclude a commercial agreement with Data Loop via PHZ [Foreign Trade Enterprise] METRONEX;
--appoint Karpinski as chief of the newly created section.

In accordance with this document, Karpinski was designated plenipotentiary technical director of the MERA for initiating the production of minicomputers at the ERA plants, and it also authorized him to contact directly members of the MERA directorate and to speak out, in coordination with MERA's technical director, on matters concerning preparing and initiating production of minicomputers.

At the same time, Karpinski was obligated to develop the microcomputer principles by 15 July 1970 and to present these principles (after coordination with Data Loop) for approval to the MERA technical director; he also was obligated to personally file written weekly reports to MERA's technical director. MERA's directors and sections subordinate to them were obligated to provide optimum help in developing and initiating production of the microcomputers. Based on this order, Z. Miedzychocki, director of the ERA ZWPP [Measuring Instruments Plants], issued on 7 August 1970 Directive DN 33/70 (in force 1 July 1970) regarding the formation within the ERA of a Development-Production Section whose goal was to develop and produce a small digital computer having universal applications. Karpinski was entrusted with the task of director and was employed in this position as of 1 July 1970.

The above formal-organizational activities and documents defined the K-202 project and gave it its form and organizational structure.

The growth in personnel employed in this section was as follows: July 1970--3 people; December 1970--52; July 1971--105; December 1971--128; March 1972--169 [65].

On 9 July 1970, Karpinski obtained the approval of the ZWPP ERA director to continue work as a consultant on computers for Data Loop and MB Metals Ltd up to 30 September 1970 [6].

Based on T. Pajkowski's statement, it can be said that from 1967 to June 1970 (directly from the presented facts) that the group directed by Dr Jerzy

Keszczynski worked on K-202 software, including a simulator of K-202 instructions on the ODRA 1202, the structure of the ASSK symbolic language, and a set of tests to verify the effectiveness of the instructions [21].

Among the mentioned documents, two of them, that is the initial MERA-Data Loop agreement and Official Order No 16/Pfn/70, established the time schedule for realizing the K-202 project, namely [4]:
--to develop a detailed schedule by 15 July 1970;
--to develop the microcomputer principles by 15 July 1970;
--to coordinate the design principles with Data Loop by 15 August 1970.

It is difficult to determine from the available documents if these schedules were maintained; on the other hand, there are no clues that anyone questioned the maintenance of these schedules.

The initial period of work at the ERA sections was dedicated to preparing the development of a model and to organizationsl matters, of which the most important one was the completion of the section's staffing.

2.2 Second Year of the Project--1971

During this period, the first problems associated with realizing the K-202 minicomputer appeared [8]. According to Karpinski, these problems were caused by delays in formal actions (sending a letter to Lord regarding the formation of the ERA section), by delays in ordering Polish peripheral equipment, and by the nonrealization of the previously established schedule for the ODRA 120 to initiate software work, and by the nonrealization of decisions of the council held 16 January 1971 and attended by vice ministers Kuczma (Planning Commission), Kopiec (MPM [Ministry of Machine Building Industry]) and Jasicki (KNiT) and Directors Twardon (MERA), Miedzykocki (ERA), and Karpinski (ERA). At that time it was decided to create the ERA OBR [Research and Development Center] for Mathematical Machines, allocating $150,000 to purchase components, subassemblies and peripheral equipment as well as $650,000 to purchase technical equipment for production in 1972.

A document entitled "Basic Design" and dated 12 October 1969 was sent to the ERA on 7 April 1971.

On 4 May 1971, agreements were signed between PHZ METRONEX and Data Loop, between PHZ METRONEX and MB Metals, and between Data Loop and MB Metals [27, 28, 29]. Among other things, these agreements specified the obligations of both sides concerning software production. Data Loop was obligated to deliver to METRONEX an executive program with an assembler as well as a library of programs for elementary functions, a package of test programs and a library of subroutines (by 31 July 1971) and a FORTRAN compiler (by 30 October 1971). In turn, METRONEX was supposed to supply to Data Loop an ALGOL compiler (by 31 March 1972) and a BASIC compiler (by 31 July 1972). The agreement between METRONEX and MB Metals also called for the delivery of a pretested and fully operational K-202 computer together with its technical documentation by 31 July 1971 [28]. This prototype was delivered 29 December 1971. Delays were not contested by MB Metals. The group did not get the documents concerning the formal transmittal of software specified in the agreement.

By virtue of Official Order No 7 of 31 July 1971, MERA's chief director appointed a commission to research the K-202. The commission demonstrated a working model of the K-202 [9]. After two meetings, the commission decided to terminate its activities since at that stage of their work on the K-202 essential information was lacking to evaluate hardware and software.

On 12 October 1971, within the framework of the agreement of 4 May 1971, a contract was signed between METRONEX and MB Metals to deliver 15 4Kb CPUs (central processing units) equipped with ASR [automated systems] teletypes, an automatic program loader and ASSK, BASIC, FORTRAN, ALGOL and COBOL software with the proviso that the deliveries should be made in 1972 [34]. The time for the delivery of the CPUs designated in the contract was 10-16 weeks after parts and subassemblies were received from MB Metals. It should be noted that COBOL software is also mentioned in the contract, which in general was not anticipated. The contract was signed by MB Metals and PHZ METRONEX representatives and was initialed by Karpinski.

Within the framework of the contract, deliveries were made from March 1972 to July 1972. The group had access to a large number of documents from which it was indicated that its contractors (first the ERA section and then ZDM [Minicomputer Experimental Center] of the IMM [Institute for Mathematical Macines]) had many problems in general in realizing purchase orders mainly for imported components and subassemblies, as well as in obtaining foreign-exchange allotments for these imports. Karpinski placed the blame on MERA (foreign-exchange limits) and PHZ METRONEX (delays in sending out orders and also not sending out orders at all). On the other hand, MERA and PHZ METRONEX accused Karpinski of placing orders directly with Data Loop and MB Metals, ignoring PHZ METRONEX which is in violation of the legal order existing in Poland.

On 14 June 1972, MB Metals sent a telex to PHZ METRONEX regarding research on the three K-202 processor prototypes delivered to MB Metals within the framework of the contract of 12 October 1971 [13]. In addition to the critical remarks in the telex concerning the transmitted units, new conditions were imposed which were beyond the agreement and contract, for example, the delivery of a multiprogram operating system and other software [18]. The group did not receive the document containing the reaction to the content of this telex which was transmitted to the IMM.

2.3 The Third Year--1972

On 22 January 1972, Vice Minister A. Kopiec formed a commission to research and assess the K-202 minicomputer. As a result of its activities, the commission issued a final protocol which was signed 1 December 1972 [22].

On 21 February 1972, Karpinski sent a letter to the MPM [Ministry of Metal Industry] in which he requested a thorough investigation of the matter of improving production conditions for the K-202 minicomputer [61]. In its reply letter, the MERA (via Order No 10 of 3 March 1972 of the Chief Director) designated ZDM IMM as the production plant, based on the Research and Development Section of the ZWPP ERA Mathematical Machines. Available

documents indicate that this decision, preceded by preparations to designate an independent production plant, did not normalize the situation regarding filling orders for components and subassemblies to manufacture the K-202. As time went on, official letters and memos concerning foreign-exchange limits and the filling of orders were circulated [56].

Based on Official Order No 12 of the MERA director of 8 July 1982, a commission consisting of representatives from the IMM, ZDM IMM and PHZ METRONEX, met from 13-15 July 1972 to assess the status of export commitments of the K-202 minicomputers realized to date. The commission prepared a protocol which recapitulated the status of the K-202 accomplishments. The protocol contains conclusions of which the most important one for realizing the project is the one about guaranteeing conditions for executing the obligations specified in the contract, and the necessity of MERA to make a decision concerning further financing of K-202 production and the volume of this production [12].

On 1 December 1972, MB Metals requested that PHZ METRONEX supply them 15 K-202 processors [38]. This request was fully accepted by Karpinski [39]. As a consequence of this request, the agreement between PHZ METRONEX and MB Metals concluded 4 May 1971 was terminated [28]. The understanding regarding the termination of agreements and conditions for this termination are presented in a separate document which was signed 22 February 1973 [13]. It was preceded be extensive correspondence in which Data Loop and MB Metals gave signals of much interest in the K-202 and extensive market possibilities as well as about difficulties in collaboration that were encountered during the realization of the K-202 project [67].

Another letter appeared after the agreement with MB Metals was terminated, and individuals and groups appeared before the secretariat of the Central Committee--S. Kowalczyk and J. Szydlek--as well as before E. Gierek suggesting that the K-202 production be continued for domestic user needs [56].

The finale of the K-202 project was the meeting of 10 April 1973 between MPM Minister T. Wrzaszczyk and representatives of the PZPR Central Committee, MERA's chief director and scientific director Karpinski. At this meeting, Minister Wrzaszczyk decided:
--to develop by 15 June 1973 the general principles for a family of minicomputers which take into account domestic needs and utilize the experience obtained from developing the K-202 and other machines;
--to use the results achieved to date and the laboratory potential and experience of the K-202 Group to realize the minicomputer development program; and for its work and accomplishments to date the group would be recognized;
--to produce 30-40 K-202 minicomputers in 1973 from imported material; appropriate funds for supplementary imports would also be allocated;
--to appoint Karpinski to the position of Chief Designer of the ZD [Experimental Center] for Minicomputers.

Then Karpinski was dismissed as the director of the ZD IMM, and attempts were made to induce him to accept the position of chief designer of the ZD IMM. Karpinski did not accept the position. The group started to disband; some

found other work, but most of them got involved with producing the MERA 400 minicomputer. These decisions practically and definitely ended work on the K-202 especially development work.

Up to 10 March 1973, 27 CPUs were produced of which 14 had memories of 4K words and 12 had memories of 12K and 16K words. Four auxiliary operating memory modules having capacities of 32K words and 50 controllers for character units were also produced, and the production of three automation channels was also advanced.

3. A Technical Assessment of the K-202 and Its Application Possibilities

3.1 The Basis and Scope of the Assessment

During the 1971-1973 period, the technical assessment of the K-202 was the subject of a number of commissions formed by MERA's directorate and the directorate of the MPM. The technical characteristics of the K-202 minicomputer presented in this work is the synthesis of all the results achieved by all the commissions investigating the matter as well as the opinions of individual specialists.

The work is based on the opinions of:
--the Commission to Assess the K-202 Electronic Digital Computer Program and its Research Results which was formed by MERA's directorate in July 1971 [17];
--an expert called by the commission [17];
--MB Metals on the three K-202 units it received [18];
--members of the group working on the K-202 minicomputer which was issued in conjunction with improving K-202 production [19, 20, 21];
--the Commission to Investigate and Assess the K-202 Minicomputer [22];
--the Commission to Assess the Possibility of ZDM Accepting Data Loop's Order [23, 24, 25].

In the area of hardware, the assessment of the K-202 minicomputer encompasses:
--architecture and logical structure;
--technical level;
--configuration.

In the area of software it encompasses:
--structure of the basic software;
--technology for generating the basic software.

And in the area of assessing applications, it encompasses:
--the trend of potential applications for the K-202 minicomputer.

3.2 Hardware

3.2.1 Architecture and Logic Organization

The Instruction Set

The K-202 instruction set contained 90 instructions realized on the basis of hardware (including 5 floting-point instructions) and 128 extra-coded instructions.

In examining the K-202 processor as a component of a larger computer system to process data, one should remember the lack of essential instructions that are necessary from the viewpoint of such applications as:
--multiplying whole numbers (fixed-point);
--dividing whole numbers (fixed-point);
--converting data from the base-10 system to the binary system and vice-versa;
--operating on alphanumeric characters.

Typical basic operations required two to three contacts with the PAO [operating memory] which meant that the K-202's operating speed could not exceed 300,000 operations per second when using an operating memory having a 1 ps cycle.

The Addressing System and Division of Operating Memory [17, 22]

The K-202's unit of operating memory was a 16-bit word. The accepted addressing system did not permit continuous addressing of memory beyond 64K words. Memory protection was accomplished in blocks of 4K words. To organize operations with an operating memory exceeding 64K words was impossible. The continuous addressing of areas of operating memory above 64K words would have required the realization of special programming

The Input-Output System [17, 22]

The accepted logic design for the memory channels assured off-line data transmission. The character channel transmitted data via the CPU. In this situation the transmission of each character interrupted the operation of the ongoing program. Such an organized transmission caused high usage of the CPU.

A maximum of eight memory channels and eight character channels could be connected to the K-202 minicomputer.

3.2.2 The Level of Technology

The Component Base [22]

The design was based on small- and medium-scale integrated microcircuits. All electronic components and memory modules were imported from Zone II.

Technological Characteristics [19, 22]
--modern production methods were used to produce the K-202 minicomputer which was a densely packed, light and portable design;
--the mechanical design did not assure proper strength or technology of production and service [19];
--the electrical power design did not assure certainty of operation or reliability [19];
--the somewhat low reliability of manufacturing and assembly did not assure proper operation after transport and aging [19];
--the initiation of series production would have required the introduction of necessary design changes to improve the K-202's technological advantages and automation of assembly and control-measuring operations [22].

3.2.3 The Configuration

The K-202 was designed as a modular system consisting of the following components [16]:
--CPU;
--memory channels (up to 8);
--character channels (up to 8);
--operating memory modules;
--external memory devices;
--input-output devices;
--automation channels;
--automation terminal devices.

Connecting peripheral equipment required the development of appropriate control units [16].

At the end of 1972, K-202 prototype number 8 was presented for testing in the following configuration:
--CPU with a 12K-word memory;
--two operating memory modules, 16K words each;
--channels and a configuration of equipment control units;
--operator console (teletype ASR 390);
--perforated tape reader (CT-1001);
--line printer (V-132 C);
--paper tape puncher (Facit 4070);
--X-Y recorder (UCCI).

In 1973 design work was done to include a T 7000 tape memory and a Drico disk unit in the K-202 configuration [23].

3.3 Software

3.3.1 Basic Software Structure [22]

The K-202's basic software included:
--the SOK-1 operating system;
--a BASIC interpreter;
--an ASSK-3 assembler;
--a library of programs.

The SOK-1 operating system was a modular executive program and an interpreter of the control language for single-programming operation. The SOK-1 was of modern design and included a universal package for servicing peripheral equipment.

The BASIC interpreter was a prototype of an interactive programming system.

The ASSK-3 was an elementary sysmbolic language with poor diagnostics. The ASSK did not include equipment to create microdefinitions.

The library of programs included:
--static functions;
--differential and integral calculus;
--algebra;
--analytic functions;
--linear programming;
--optimization.

An analysis of the software contained in [22] was as follows: "The presented K-202 software of the configuration under investigation was incomplete even from the viewpoint of K-202 microcomputer applications. From the viewpoint of treating the K-202 as a universal system, it is only rudimentary. Relative to the software of other minicomputers (for example, the Varian 620) the presented software is poor."

3.3.2 Technology for Generating Basic Software[2]

All elements of the basic software were generated using traditional technology. No supporting resources were used to generate software, such as a generator of XPL compilers, end-to-end compilers and the like. The extensive dispersal of work on the basic software had a negative effect on the time it took to generate it and on its level of reliability. An integrated system of software tests was not developed, and proper control of generated software quality was not organized.

3.4 Trends of Potential Applications

The commission formed 22 January 1972 considered the following K-202 applications to be the preferred ones [22]:
--automation of techological control processes;
--scientific-technical and engineering calculations;
--the gathering, preparation and initial processing of data.

A condition for using the K-202 minicomputer to realize the above applications was to equip it with appropriate peripheral equipment as well as necessary software. It was noted that the K-202 is a necessary complement to the computers produced in Poland (the ODRA 1300 and RIAD 32) [22].

4. An Economic and Commercial Analysis of the K-202 Project

4.1 A recapitulation of the commercial coproduction agreements concluded by MERA and PHZ METRONEX with the English firms:

a) MERA-Data Loop of April 1970 [3];
b) METRONEX-Data Loop of May 1971 [27];
c) METRONEX-MB Metals of May 1971 [28];
d) Data Loop-MB Metals of May 1971 [29].

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2. As assessed by the group.

4.1.1 On 11 April 1970, the initial agreement between MERA and Data Loop concerning cooperation in the development and production of a minicomputer was signed [3]. This agreement established the following model of cooperation:

A. The English side would assure:
--the design principles of the minicomputer authored by Karpinski, consultant to Data Loop;
--gratuitous subassemblies and material worth up to 25,000 pounds sterling;
--ASSEMBLER language software, a library of elementary function programs and a FORTRAN compiler;
--a market in England for a minimum of 300 units annually.

B. The polish side would assure:
--designing a model and prototypes in Poland by Karpinski's group;
--testing of the prototypes;
--the supervision of Karpinski over the project, from the model stage to the production stage and to the testing and development of software;
--series production to be designated for export after the prototypes were approved.

In addition the sides agreed to sign in the very near future a detailed agreement with the participation of a Polish foreign trade enterprise which would represent MERA's interests.

4.1.2 During the course of realizing these agreements, three commercial agreements were signed on 4 May 1971 [3]:
--PHZ METRONEX and Data Loop [27];
--PHZ METRONEX and MB Metals [28];
--Data Loop and MB Metals [29].

A. The METRONEX-Data Loop Agreement [27]
The subject of the agreement: the K-202 minicomputer was defined as follows: "An original, small computer of advanced design developed on design principles which are the property of Data Loop, having all or some of the following units: a memory-unit processor, memory channels, input-output interfaces and multiplexers."

Data Loop was obligated to:
a) provide the K-202 design principles authored by Karpinski;
b) deliver software (apart from the ALGOL compiler and BASIC compiler);
c) patent the K-202 in Poland and England jointly with PHZ METRONEX and the joint protection of these patents.

PHZ METRONEX was obligated to:
a) produce K-202s under the supervision of Karpinski;
b) pay Data Loop a 5 percent royalty for each K-202 sold outside Poland;
c) together with Data Loop, patent the K-202 in Poland and England as well as jointly protect these patents;
d) give Data Loop the exclusive right to sell the software outside Poland.

B. The METRONEX-MB Metals Agreement

The object of the agreement: "Original K-202 computer being a serially derived family of computers and having all or some of the following equipment: a processor, memory units, memory channels, input-output interfaces and multiplexers."

MB Metals was obligated to:
a) guarantee gratuitous subassemblies and materials worth up to 25,000 pounds sterling;
b) develop a model and prototypes;
c) prepare commercial literature and service instructions;
d) assure the marketing and servicing of the K-202 outside Poland in the following amounts:
--first party--10 units minimum;
--during the second stage, 100-150 units minimum (first year) and 300-1,060 units the second year;
--deliveries in years to follow to be agreed upon.

The second stage would depend on MB Metal agreeing with the technical conditions of the first party of the commercial output (10 units minimum).

PHZ METRONEX was obligated to:
a) develop a K-202 prototype;
b) deliver to the first commercial party a minimum of 10 units;
c) execute orders from MB Metals for the number of K-202 devices specified in the agreement (on the basis of exclusivity).

c. The Data Loop-MB Metals Agreement

Object of the agreement: cooperation in the area of K-202 sales and operations associated with these sales. The K-202 design principles and documentation are the property of Data Loop. Production drawings and technical documentation are the joint property of Data Loop, MB Metals and others. Data Loop will deliver to MB Metals K-202 software. MB Metals will pay Data Loop a royalty of 5 percent for each K-202 sold. MB Metals appoints Data Loop as the subdistributor of the K-202 and its software in the CEMA countries, Finland, China and Yugoslavia.

In summary it should be stated that:
a) At the time the agreements were signed only the following existed: a K-202 model and the design principles authored by Karpinski, being the property of Data Loop. Also from this the formulations are imprecise in defining the technical object of the agreements, and they only define the rights and obligations of the sides in a general way.
b) The concluded agreements are of a provisory nature because they subject the production, development and sale of the K-202 to the realization of an assumed level of export, which in turn is dependent on the acceptance of the prototype by MB Metals and the first commercial party.

4.2 Financial Outlays in Circulation-Type and Foreign-Exchange Zlotys for K-202 Production, an Account of Losses and Profits

According to MERA's declaration (Attachment No 1 to the letter): "During the 1970-1973 period MERA (together with ERZE [expansion unknown] and ZD IMM) spent about 160 million zlotys as well as 3,292,575 KK [capitalist countries] foreign-exchange zlotys on the K-202 project. It is a fact that in accordance with the contract the object of the export to MB Metals was only supposed to be a processor having a 4K memory capacity and not the K-202 minicomputer.

According to the contract, we were supposed to receive from MB Metals $6,200 for each processor with import outlays of about $2,500. The value in zlotys of one processor having a capacity of 4K words was about 250,000 zlotys. It also is a fact that for peripheral equipment purchased from the capitalist countries for the K-202 minicomputer we paid at that time:
--$7,000 for a DRI-31 or CDC 9425 memory disk;
--$5,000 for a Westinghouse 1600 CRT monitor;
--$1,850 for a Facit 4070 tape punch;
--$1,850 for a DYANMIOS 390 teletype.

Thus it can be seen that the prices in foreign-exchange for some peripheral devices were higher than the price for the K-202 which was supposed to be the object of export to MB Metals.

The above 3,292,575 foreign-exchange zlotys were allocated as follows:
--about 75 percent for the purchase of components, subassemblies and peripheral devices for the K-202;
--about 25 percent for the purchase of apparatus and equipment to produce the K-202. But foreign-exchange income was not received from MB Metals by way of compensation for K-202 subassemblies sent to Poland, except for $93,000 for 15 processors having capacities of 4K each.

At the same time, as indicated by MERA's study, in 1972 the computer industry employed 2,692 people while ZD IMM, which was only producing the K-202, employed during this same year 271 people, that is about 10 percent of all the people employed in the branch [31]. The study also indicates that total financial outlays for 1971, 1972 and 1973 for scientific research and application work in the field of technical resources for information science was about 1.51 billion zlotys which means, according to statement [30], that the expended sum of 160 million zlotys represented about 10 percent of total outlays.

Study [31] also indicates that the total value of coproduced imports from Zone II in MERA's Information Science Branch amounted to 24.28 million foreign-exchange zlotys for 1971, 1972 and 1973, and thus the sum of 3,292,575 foreign-exchange zlotys expended in foreign exchange for the K-202 project represented about 14 percent of MERA's total foreign-exchange outlays for coproduction imports during this time period.

According to [31], a total of 28 K-202s were produced of which 15 were exported to England for a total of $93,000 and 13 units were sold in Poland

for about 26 million circulation-type zlotys (according to letter [32]. each system cost an average of 2 million zlotys).

An estimate of ZD IMM's profits and losses for the 1970-1973 period in circulation type zlotys is as follows:

outlays --- 160 million
income --- 26 million
profit --- --
loss --- 134 million.

In foreign-exchange zlotys:

outlays --- 3.3 million
income --- 0.3 million
profit --- --
loss --- 3.0 million.

The above estimate of profits and losses is a microscale view, that is it shows that ZDM IMM incurred losses of 134 million circulation-type zlotys and 3 million foreign-exchange zlotys, but it does not answer the basically placed question on the macro scale, on the scale of the entire national economy, namely: Should have this production been continued?

The cited account of profit and losses could have impelled a decision about stopping production, since the losses amounted to 134 million circulation-type zlotys and 3 million foreign-exchange zlotys, and the outlays were at about a level of 10 percent of the branch's total outlays along with a relatively high level of coproduction imports which already amounted to about 14 percent of the coproduction import of this branch's association, but the decionmaker did did not authorize the undertaking of such a decision without taking into account the following decisionmaking elements:
--the technical level of the product;
--realistic prospects for export;
--domestic needs and the anti-import character of the production;
--limits on ownership and patent rights;
--import-intensiveness of the product and embargo limitations.

Only after an analysis of the course for realizing the agreements concluded with the English firms will we be able to completely assume an attitude toward these questions."

4.3 The Course for Realizing the Agreements Concluded with the English Firms

4.3.1 The METRONEX-MB Metals Agreement

In accordance with the METRONEX-MB Metals agreement, a prototype of the K-202 CPU together with documentation and technical drawings needed to prepare commercial literature and service instructions and to service the K-202 was delivered [28]. The prototype was delivered in December 1971, that is several months late. However, in the acceptance report for the prototype,

MB Metals stated that the delay was their fault exclusively and was caused by the off-schedule deliveries by this firm of some subassemblies [33].

MB Metals placed an order for the first commercial party--15 K-202 CPUs having 4K capacities. According to the agreement, the delivery was supposed to be of a decisive nature because it would determine the success of the entire project [28].

The detail contract of 12 October 1971 specifically called for the delivery of 15 K-202 CPUs having 4K capacities and costing $6,200 per unit [34]. The deliveries were made on schedule, that is, during the March-July 1972 period. During this time, MB Metals expressed interest in purchasing one complete K-202 microcomputer system, but the order depended on the quality of the 15 CPUs, in accordance with the agreement [28]. On 1 December 1972 MB Metals sent a letter of complaint to PHZ METRONEX in which it stated: "...MB Metals is forced to reject the 15 K-202 CPUs for the following reasons:
1) the lack of restart equipment near the network power-feed sign;
2) the lack of an interface buss;
3) nondelivery of software--the operating system."

At the same time MB Metals stated in letter [35]: "...the fact that we have not obtained completely proficient processors makes it impossible for us to place an order for systems."

In a letter to PHZ METRONEX, the ZDM fully acknowledged the scope of the complaint detailed in MB Metal's letter of 1 December 1972 [35, 36].

The group paid special attention to the technical conditions of the contract of 12 October 1971 regarding the delivery of 15 K-202 CPUs and the fact that Karpinski, ZD IMM director, acknowledged the above-mentioned complaint [31].

The group established the following:
--The contract of 12 October 1971, the commercial as well as technical portions, was signed by METRONEX representative J. Dziewiecki and H. Zukowski, and ZD IMM Director Karpinski, and by C.D. Hinchliffe of MB Metals.

--The technical conditions of the contact anticipated the delivery of ASSK, BASIC, FORTRAN IV, ALGOL (in 1972), and COBOL (1972) software in the cost of the product.

--MB Metal's complaint of 1 December was sent to ZD IMM via METRONEX on 4 December 1972. In its main letter, METRONEX states [38]: "...we request a formal opinion on the justification of the complaint and the feasibility of settling it...."

--In a METRONEX official document, on a copy of the above-mentioned letter, there is a hand-written note by Director Karpinski dated 13 December 1972 which reads as follows [39]: "...we consider the complaint to be justified and accept it. Points 1 and 2 can be corrected in 4 weeks after the defective processors and components needed to rework them are received (cost about 30 pounds sterling per unit). Point 3 can be delivered for verification during the committee reception which we propose to hold in Warsaw."

--In the letter of 16 December 1972 to PHZ METRONEX, Director Karpinski reacknowledged the complaint in its entirety and in addition rescinded the decision regarding point 3 ordering a committee reception in Warsaw.

--PHZ METRONEX did not accept the complaint.

With regard to the unsatisfactory quality of the K-202 first party, MB Metals decided to cancel other purchases. On 22 February 1973 the agreement of 4 May 1971 was terminated [13].

In the existing situation, METRONEX began to actively seek other firms interested in purchasing the K-202. Offers were sent, direct talks with the English firms RACAL and CDC were held, but these firms showed no interest. Also, talks conducted with Data Loop produced no concrete results because this company, having only several employees, had neither a sales network nor any influence on important distributors, nor did they have the means to finance the purchase in which they were interested.

4.3.2 The METRONEX-Data Loop Agreement

--The K-202 design principles were sent by Data Loop to the ERA plants on 7 April 1971.
--The obligation of the firms to deliver software in accordance with point 1a of the agreement was executed and confirmed by Data Loop letter of 22 November 1972 to PHZ METRONEX and reconfirmed by Data Loop letter of 4 May 1973 to PHZ METRONEX [40, 41].

With regard to this, Data Loop cited the written confirmations of Karpinski dated 4 December 1972 which, among other things, gave cause for a lawsuit in an arbitration court in Basel, Switzerland [54].

It should be noted that the IMM, in its letter N/1393/3121/75 dated 15 May 1975 and signed by Director Janicki and Director Karpinski, which was sent to PHZ METRONEX, negates the complete execution of obligations concerning software by Data Loop [43]. In addition, in the record of the matter one finds the statement of Eng Teresa Pajkowska of 13 July 1972 which states that the software was in fact developed in Poland by the group headed by Dr J. Leszczynski (PKP [Polish State Railraods] Center) during the period from 1969 to June 1970 and then from September 1970 by the ERA Plant Group (Department of Mathematical Machines) and not by Data Loop [21]. Because of its inportance, this matter requires additional full explanations to establish the probable losses on the Polish side exclusively.

--Data Loop did not fulfill its contractual obligation to jointly patent the K-202 in Poland and England. On the contrary, Data Loop in concert with Karpinski submitted a patent application on 6 April 1973 to the British Patent Office, ignoring PHZ METRONEX. During the arbitration process in Basel, Switzerland, Data Loop submitted a letter on this subject matter to Data Loop which was dated 18 January 1975 and signed by Karpinski which authorized this firm to unilaterally apply for patents and thus ignoring the Polish side [45]. The contents of the letter in its original [English] form is as follows:

"I hereby confirm that in contravention of the Agreement between Metronex and Data Loop wherein my position as Director and Executive controller of the project was clearly stated, I was dismissed from my post on very short notice without any valid justification being given.

"Subsequently I was offered the alternative position of 'Chief Constructor' which I refused to accept as not in keeping with the original conditions accepted by all parties at the commencement of the project. The position of Chief Constructor embraces the leadership of design only, without executive authority for policy which is vested in the Directors of the Factory for Minicomputers ZDM.

"The Chief Constructor has no control over the production activities nor any decisive voice in investment policy.

"At the time of my dismissal, I concurred with the opinion of Data Loop Ltd that the Agreement relating to the K-202 project had been effectively broken by the Polish side and, therefore, with Data Loop's decision not to add the name of Metronex to the final submission of patent applications in London until such time as the situation was rectified."

Because of its seriousness, this matter, like the matter of software, requires additional explanations to determine the losses of the Polish side exclusively and at the same time to explain the circumstances of the patent applications. By virtue of the legally valid provision of the judgment of the Administrative District of the City of Warsaw regarding the case of IMM against Karpinski on returning the patent application plan drawn up in 1972 by the patent agent Zygmunt Palka and encompassing [46]:
a) the method of coding instructions in digital computers;
b) the parallel interface of electronic digital computers;
c) the electronic system of a digital machine;
Karpinski was obligated to give to the IMM in Warsaw the application plan. In addition the court ordered Karpinski to give to the IMM the documents described in point 1 within 7 days of the implementation of the judgment [46].

The group established that Data Loop and Karpinski filed patent application No 16684/5/73 in Great Britain on 6 April 1973 with a complete technical description of the invention on 3 July 1974 (that is after the judgment of the Administrative District Court in Warsaw) and on 20 July 1977 obtained patent numbers 1,480,209 and 1,480,208 [48]. The group stated that this matter requires additional investigation and explanations. During the life of the agreement, Data Loop did not sell a single K-202 minicomputer and did not have a sales organization or financial resources. The firm's initial capital was only 2,000 pounds sterling. On 12 February 1973 this firm placed an order with PHZ METRONEX that was not secured financially (No DL/Mtx/KTK/001/73 of 12 March 1973) for three K-202 systems worth a total of 23,730 pounds sterling with delivery to be made in an exceptionally short time span [49]:
--the MDK 001 system -- end of April 1973;
--the MDK 002 system -- mid-May 1973;
--the MDK 003 system -- in April 1973.
ZDM IMM did not confirm the above-mentioned order for realization.

An analysis of the course of cooperation with Data Loop indicates that this firm concentrated most of its activities in the Polish market, seeking Polish orders for subassemblies and peripheral equipment designated for the K-202, and in association with this many orders were placed with the firm directly by Director Karpinski, ignoring PHZ METRONEX, which made it impossible to verify prices paid and their negotiation [54].

Of the 3.3 million foreign-exchange zlotys spent for imports to realize the K-202 project, Data Loop obtained 326,000 pounds sterling, that is about 2.3 million foreign-exchange zlotys or about 70 percent of the total sum spent.

Thus, it was not so much in the interest of Data Loop to export K-202s from Poland as it was to sell K-202s in Poland because this firm lived on the sale to Poland of subassemblies and peripheral devices for the K-202. It should be emphasized here that the Metronex-Data Loop agreement did not give this firm any rights in this matter [27].

Data Loop practically became a monopolistic supplier to Poland of the above-mentioned equipment because of its exclusive right to represent the producers, as typified by Karpinski, and as a result of directly placing orders with this firm via Karpinski.

In a letter dated 26 July 1972, Director J. Kulesz writes to Director Karpinski [50]:

"The revisions made in your plant indicated that they are not in compliance with the decisions resulting from the guidelines concerning the import of machines and equipment initiated by the administration of the Ministry of Foreign Trade. Equally onerous was the direct ordering by you from foreign suppliers of equipment and material as well as their receipt without the knowledge and agreement of PHZ Metronex. Along with this, it should be emphasized that such a practice makes it difficult to verify the actual status of deliveries and to execute bilateral clearing of accounts. In view of the negative effects of your practices in this area, MERA was forced to issue appropriate verification instructions."

In its letter of 22 May 1972 to the KBI [National Office of Information Science] which was signed by Director Karpinski, concerning the sending of foreign exchange to import external and peripheral equipment for K-202 systems, the ZD IMM asked for a guarantee of foreign exchange amounting to $481,000 (that is about $50,000 for each K-202 system) to import equipment produced by Data Dynamics, Facit, Westinghouse, Wang, Centronics, Racal, Thermonic and BASF. For the most part, these firms were represented in Poland by Data Loop. Attempts, which were naturally time consuming, by PHZ METRONEX to change this state of affairs by seeking out other sources of suppliers and negotiating for lower prices were made impossible by constant pressure to accelerate the system of supply contracts and the allegations of sluggishness in contracting for equipment and subassemblies from Data Loop.

The high import-intensiveness of the K-202 (about $1,930 for each PCU having a memory capacity of 4K words, invoice value of $6,200), plus the almost

100 percent import-intensiveness of peripheral equipment subordinated production to the embargo policy of the U.S. Department of Commerce, especially in the area of MM-4-1 matrix memories produced by Data Products. The American authorities demanded information concerning the use of these matrices and the nature of the users [52].

Then Data Loop tried to create a model of collaboration which would assure it of complete control over the design, production and marketing of the K-202 hardware and software by virtue of:
--possession of the design principles developed by Karpinski;
--possession of the patents by unilaterally applying to the British Patent Office with the agreement and participation of Karpinski;
--possession of the software developed in Poland on the order of Karpinski;
--assuring control for itself over the importation of subassemblies to produce the K-202 by obtaining the right of exclusivity for Poland from the producers, attempting to create a mechanism to order the above-mentioned components directly via Karpinski while ignoring PHZ METRONEX.

The above statements allow one to understand the essence and genesis of the arbitration process brought about by Data Loop against PHZ METRONEX after K-202 production was discontinued.

4.4 Recapitulation of the Data Loop Arbitration Process Against PHZ METRONEX in Basel, Switzerland [54]

In accordance with the contingencies described in point 10 of the agreement of 4 May 1971, on 28 February 1977 Data Loop brought suit against PHZ METRONEX in the Arbitration Court in Switzerland to obtain a judgment for damage for the following amounts [27]"

a) [Following in English]

1)	Air fares, hotel, travel and incidental expenses (including visits of Polish personnel to the U.,.) up to 31/12/75	pounds sterling	
	D.H. Lord	6,736	
	J. Karpinski	1,254	
	A. Jenkins	558	
	Mrs L. Granleese	150	
	L.C. Hawken	462	
	A.B. Roberts	120	
			9,280
2)	Ditto since 1/1/76		
	A.B. Roberts	550	
	D.H. Lord	1,000	
			1,550
3)	Consultancy fees		
	J. Karpinski	13,500	
	A. Jenkins	3,000	
			16,500

4)	Hardware, software, components and tools	3,000	
	Software development costs (other than FORTRAN)	1,500	
			4,500
5)	Exhibition and E. European travel (other than Poland)	2,000	2,000
6)	FORTRAN compiler	7,000	7,000
7)	Components ordered by UNITRA as agent for METRONEX for use in K-202 by ZDM	5,000	5,000
8)	Legal costs	5,000	5,000
9)	Proportion of telex, telephone and other direct administration costs on K-202	2,500	2,500
			53,330

b) General damage being loss of royalty on sales of K-202 by main distributor, loss of profit on sales of K-202 and peripheral equipment to Data Loop and loss of profit on sales of K-202 software by Data Loop.

1) Loss of royalty on main distributor's sales:

Minimum unit sales envisaged in preliminary proposals dated 1 April 1970 being 1,680 units adjusted over 7 years; and minimum sales units envisaged in agreement dated 4 May 1971 between METRONEX and MB Metals being 1,600 units adjusted over 7 years; average net price of K-202 units (as defined in 1971 agreements) being 3,000 pounds sterling; minimum value of K-202 sales being therefore 12.8 million pounds sterling Data Loop royalty at 5 percent is

640,000

2) Loss of profit on sales of K-202 peripherals by Data Loop:

Data Loop being in negotiation for business of a gross value of approximately 800,000 pounds sterling on February 1973; and Data Loop having the reasonable prospect of gross sales totalling additionally 2 million pounds sterling during the currency of the agreements of 1971; and Data Loop obtaining an average net profit of 5 percent on such sales, its total loss of profit would be

120,000

3) Loss of sales of K-202 software by Data Loop:

Data Loop having a reasonable prospect of gross sales of a value not less than 100,000 pounds sterling during the currency of the agreements of 1971; and Data Loop obtaining an average net profit of 20 percent on such sales its loss of profit would be

	20,000
	780,000
Total	833,000

[End English]

Data Loop complained that PHZ METRONEX:
1. Caused the termination of the agreement with MB Metals by delivering poor-quality equipment;
2. Dismissed Karpinski as plant director;
3. Discontinued K-202 production.

During the long process, METRONEX proved that it bore no responsibility for the termination of the agreement with MB Metals and the withdrawal of this firm from further collaboration. METRONEX never recognized MB Metal's letter of complaint, delivered good-quality products in accordance with the contract, and the repairs made by the producer (ZDM IMM) and its acknowledgement of the complaint did not make further collaboration impossible. METRONEX proved that this matter cannot be an object of dispute between Data Loop and PHZ METRONEX. The termination of the MB Metals-METRONEX agreement occurred with the approval of Data Loop and Data Loop's claim in this matter is baseless. Since Data Loop claims PHZ METRONEX terminated the agreement, then why does it not make the same claim against MB Metals?

METRONEX proved that Karpinski used his official position to take a number of actions that benefited Data Loop and he did not fulfill his duties as the plant director, and in addition:
--developed the design principles for the K-202, which are the property of Data Loop and which contain basic errors in the construction of the list of instructions which made the delivered software worthless and made it necessary for the Polish side to start work all over again;
--ordered a much greater assortment and number of peripheral devices from Data Loop than was necessary for design and development activities;
--ordered equipment from Data Loop for which the firm had exclusive sales rights as an agent despite the act that these devices were not constructively perfected;
--ordered equipment incompletely (without additional equipment) which could not be used quickly and effectively;
--acted in behalf of Data Loop, using the producer's employees for this purpose;

--harmed ZDM IMM by concealing the actual costs for developing the FORTRAN IV translator ordered by Data Loop, showing its cost to be 5 percent of the true cost (in effect, the reason for the symbolic sum of 7,000 pounds sterling was to procure the FORTRAN IV translator with the right to sell it);
--applied for K-202 patents at the British Patent Office which is in violation of the agreement of 4 May 1971 between PHZ METRONEX and Data Loop and in defiance of the Polish court's judgment of May 1974.

In addition, METRONEX stated that the above activities, including the actions benefiting Data Loop, justified the dismissal of Karpinski as ZDM IMM's chief director and that offering him the post of chief designer was included in the decisions of the agreement of 4 May 1971. Karpinski did not accept the offer.

METRONEX proved that K-202 production was undertaken as an export project requiring the close collaboration of the three interested sides. The withdrawal of MB Metals from collaboration, the lack of real interest from other firms, Data Loop's financial and organizational-marketing inability to distribute the K-202 on a large scale, and embargo difficulties led to the cancellation of this production because it represented a source of foreign-exchange drain for the Polish side, a pump sucking out foreign exchange from Poland mainly for the benefit of Data Loop which, in an illegal manner, patented the K-202's basic technical design with the approval of Karpinski as verified by his letter of 18 January 1975 to Data Loop in which he stated that the Polish side broke the agreement and thus authorized Data Loop to apply for patents [45]. In this situation, the Polish side was forced to stop K-202 production.

On 12 January 1979, the Arbitration Court in Basel, Switzerland issued a judgment in which it was adjudicated that [54]:
--the MB Metals-METRONEX agreement was terminated 21 February 1973 with the approval of both sides;
--negotiations between Data Loop and PHZ METRONEX concerning further collaboration continued to the end of 1973;
--on 21 July 1974, Data Loop advised PHZ METRONEX that it intended to take the matter into arbitration in accordance with point 10 of the agreement;
--on 28 February 1977, Data Loop stated precisely in its suit its claim for 833,000 pounds sterling, presenting its accusation relative to PHZ METRONEX on the basis of the agreement concluded 4 May 1971 [27];
--the concluded agreements of 4 May 1971 do not authorize Data Loop to present the claims contained in the suit;
--PHZ METRONEX protected its rights and discharged its obligations resulting from the concluded agreements;
--in the agreement, Data Loop did not assure for itself its rights regarding the eventual return by METRONEX of incurred actual costs, instead it was a commercial risk for Data Loop;
--Data Loop's claim concerning presumed losses (lucrum cessans) is without any legal basis at all, even though this firm has a moral right to a certain amount of remuneration for transmitting to PHZ METRONEX the K-202 design principles, know-how and software, even if it was in the form of participation in the process costs.

In conclusion, the court dismissed Data Loop's claim, and the processing costs were covered jointly by both sides, equally shared. This judgment is legally valid and cannot be abrogated.

5. Conclusions

Below are the conclusions resulting unequivocally from the presented analyses. All of them can be justified by virtue of the considerations made in points 1-4 of the report which were quoted or by virtue of the opinions of the group after analyzing the documents. The group was unable to obtain answers to all the questions that arose. The less important questions were omitted and the important ones are presented at the end of this section.

The following eight conclusions were reached:

--the technical characteristics of the projected K-202 computer which were presented in 1970 were comparable with equipment then being produced in the world (point 2.1, point 3.2);
--the commercial agreements signed by PHZ METRONEX with Data Loop and MB Metals were the basis for export production, but the continuation of the project depended on the evaluation of product quality of the first part by MB Metals (point 2.1, point 4.1). The evaluation was negative [35];
--the directives issued by the directorate of PiAP MERA and its subordinate units were the basis for initiating K-202 production (point 2.1), in accordance with the assumptions of Document 1 issued by Karpinski, as a priority MERA task;
--the assumptions presented in 1970 regarding the K-202 and the production timetable were optimistic [1]. The investigations made in 1973 showed that these assumptions were not fully realized (point 2.1);
--the K-202 copies were manufactured from parts that were for the most part imported. The peripheral equipment with which the K-202 configuration was equipped were also imported (except for the CT 1001 reader). K-202's internal memory contained imported MM-4-1 matrices produced by Data Products (the United States) which were affected by the embargo [52]. The license to import this part contained limits on quantities (point 3.2) and also required Poland to provide information on the sale and installation of each K-202 configuration.

With K-202 series production, the group believes that the exchange of imported subassemblies from Zone II for subassemblies manufactured in Poland lowered K-202 quality regardless of the virtues of the model;
--the realization of the project in the framework of the commercial agreements with MB Metals and Data Loop lagged behind causing discouragement and apprehensions on both sides, and the K-202 minicomputer did not achieve the assumed technical parameters;
--the negative assessment made by MB Metals of the first party for the 15 K-202 processors that was expressed in the letter of complaint of 1 December 1972 caused the termination of the agreement with MB Metals on its initiative [35, 38, 39]. This wrecked the export character of the project;
--the patenting of two important K-202 features in Great Britain by Karpinski and Data Loop can have legal consequences for the Polish side in case the patented design is used in the future (point 4.3).

The group was unable to provide details on the basic software produced in Poland that was procured by Data Loop (point 4.3.2).

The group cannot assume an attitude toward the patent problems (point 4.3.2), which in light of documents [47, 49, 54] require further explanations and investigations by institutions called on to do so.

The group cannot assume an attitude toward the legal problems concerning the simultaneous employment of Karpinski by Polish and English firms.

List of Documents

[1] The production of minicomputers in collaboration with English firms. Initial assumptions, 26 March 1970, signed: Engineer J. Karpinski.
[2] Letter of intention from the director of Data Loop Ltd., D.H. Lord, to the director of MERA, Engineer J. Huk, 30 June 1970.
[3] Initial agreement between MERA and Data Loop signed by Engineer J. Huk and D.H. Lord.
[4] Official Order No 16 Pfn/70 of the Chief Director of MERA, Engineer J. Huk, 30 June 1970.
[5] Instruction DN 33/70 of the director of the ZWPP ERA of 7 March 1970.
[6] Letter from ZWPP ERA Director to Engineer J. Karpinski of 9 July 1970 expressing agreement on continuation of work as a consultant for Data Loop and MB Metals.
[8] Official memo from Engineer J. Karpinski of 25 February 1971 regarding the realization of the K-202 minicomputer.
[9] Official Order No 7 of 31 July 1971 from the chief director of MERA regarding research on the K-202 digital computer (together with two statements from the Commission).
[11] Instruction No 10 of the chief director of MERA of 8 March 1972 concerning the recall of ZDM IMM.
[12] The protocol of the Commission to Assess the Realization of Export Obligation concerning the K-202 Minicomputer, dated 11 July 1972.
[13] Agreement on terminating the agreement between PHZ METRONEX and MB Metals of 22 February 1973.
[14] Resolutions resulting from the meeting with Minister of the Machine Engineering Industry T. Wrzaszczyk held 10 April 1973.
[16] Protocol resulting from the meeting of 10 September 1971 at the MERA Plants of the Subcommittee to Assess the K-202 Program and Research Results that was formed by the MERA director in July 1971.
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[18] The opinion of MB Metals on the three K-202 units it received (TELEX of 14 June 1972).
[19] E. Jezierska, A. Ziemkiewicz: "Notes on the First Party of the K-202 Machine," Warsaw, 15 August 1972.
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[21] T. Pajkowska: "Memo Concerning K-202 Software," Warsaw, 13 July 1972.
[22] Final protocol of the Commission to Investigate and Assess the K-202 Minicomputer formed by the MPM under secretary of state, Eng A. Kopiec, dated 22 January 1972, Warsaw.

[23] Protocol of the Commission to Assess the Possibility of ZDM Realizing Data Loop's Order formed by the IMM director on 22 February 1973, Warsaw, 1 December 1972.
[24] K. Jaroslawski, A. Ziemkiewicz: "Notes on Protocol [23]," Warsaw, 2 March 1973.
[25] Protocol from the meeting of the Commission to Assess the Possibility of ZDM IMM Realizing Data Loop's Order concerning the notes of K. Jaroslawski and A. Ziemkiewicz, Warsaw, 3 March 1973.
[27] METRONEX-Data Loop agreement of 4 May 1971.
[28] METRONEX-MB Metals agreement of 4 May 1971.
[29] Data Loop-MB Metals agreement of 4 May 1971.
[30] MERA letter to the Committee on Information Science of 21 April 1981 identified as TC/36/81.
[31] MERA paper entitled: "The Computer Industry During the 1971-1980 Period," April 1981, Warsaw.
[32] ZDM IMM letter of 16 December 1972 to MERA identified as ES/1096/72.
[33] METRONEX-MB Metals protocol of 29 December 1971.
[34] Contract No 31-322/0-0037/1 of 12 October 1971.
[35] MB Metals letter of 1 December 1972.
[36] ZDM IMM letter to PHZ METRONEX of 16 December 1972.
[38] PHZ METRONEX letter 322/0-0037/1-GB/E to ZDM IMM, 4 December 1972.
[39] J. Karpinski handwritten note of 13 December 1972.
[40] Data Loop letter to PHZ METRONEX of 22 November 1972.
[41] Data Loop letter to PHZ METRONEX of 4 May 1973.
[42] J. Karpinski's statement of 4 December 1972 concerning generating the software.
[43] IMM letter N/1393/3121/75 to PHZ METRONEX of 15 May 1973.
[45] J. Karpinski's letter to Data Loop of 18 January 1975 concerning patents.
[46] Judgment of the Warsaw District Court of 7 May 1974 Sygn. act III C-916/74.
[47] British patent No 1,480,209 of 20 July 1977.
[48] British patent No 1,480,208 of 20 July 1977.
[49] Data Loop order DL/MTX/KTK/001/73 of 12 March 1973.
[50] Letter from IMM Chief Director R. Kulesz (DN/2988/PZ) to J. Karpinski of 26 July 1972.
[51] ZDM IMM letter ES/263/72 to KBI of 22 Mary 1972.
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[54] Process documentation of the Arbitration Court in Basel, Switzerland. Group of documents in the Archives, PHZ METRONEX.
[56] List of documents not cited in the report, May 1981.
[60] MB Metals telex to J. Karpinski regarding the ordering of parts for the prototype, signed by Alan Jenkins.
[61] J. Karpinski's letter to the Minister of the Machine Engineering Industry of 21 February 1972, signed by J. Karpinski.
[65] MERA document sent to the group, April 1981.
[67] MB Metals letter (no addressee) of 2 August 1972, signed by M.J. Lanham.
[68] Data Loop letter to Prof J. Kaczmark of 11 August 1972, signed by D.H. Lord.
[69] MB Metals letter to Director J. Huk of 20 September 1972, signed by M. Lanham.

[70] Data Loop letter to Engineer J. Karpinski of 20 December 1972, signed by D.H. Lord.
[71] Data Loop letter to Director J. Karpinski of 12 February 1973, signed by D.H. Lord.
[72] Memo to Director A. Ziaj of 12 February 1973, signed by D.H. Lord.
[73] COPE letter to D.H. Lord of 15 March 1973, signed by B. Bignell.
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[75] Data Loop letter to Director A. Ziaj of 24 May 1973, signed by D.H. Lord.
[76] Data Loop letter to J. Karpinski of 22 May 1973, signed by D.H. Lord.
[77] MB Metals letter to PHZ METRONEX of 21 August 1972, signed by MJ Lanham.
[78] MB Metals letter to DH Lord of 11 November 1972, signed by MJ Lanham.
[79] Data Loop letter to J. Karpinski of 5 March 1973, signed by DH Lord.

11899
CSO: 2602/16

NONTRADITIONAL LIVESTOCK FODDER TO SAVE GRAIN

Bratislava SMENA in Slovak 15 March 82 p 3

[Interview with Doc Dr Vladimir Peter, CSc, of the Institute of Farm Animal Physiology of the Slovak Academy of Sciences, employed at the Agricultural College in Nitra, and researcher Jozef Huba, by Adela Strbkova: "Waste Used as Animal Feed"; date and place not specified]

> [Text] Among large so-called pollutants of the environment are large-scale breeding farms, whether they are raising hogs or poultry. As concerns poultry production, in recent years that has increased in volume as well as size of farms, in some places several hundredfold, in others up to a thousandfold. But a new problem has arisen directly in proportion with this--what to do with poultry dung? After all, its production exceeds egg production threefold and the volume of poultry meat even fivefold. It is not surprising that the problem of disposing of poultry droppings had begun to involve research centers too. Here it is primarily the Institute of Farm Animal Physiology of the Slovak Academy of Sciences in Ivanka pri Dunaji. We talked about this in more detail with nonresident specialist of the institute, Doc Dr Vladimir Peter, CSc, employed at the Agricultural College in Nitra, and with researcher Eng Jozef Huba.

[Question] Among research projects with the objective of utilizing waste materials from agriculture and industry containing nutrients for feeding farm animals, you are working on, among others, an interesting problem--making use of excrement, in this case poultry droppings, as food for beef cattle. I know, however, that this is not at all unprecedented. Even here, poultry dung has, in the past, been used as feed.

Vladimir Peter: The idea of using poultry droppings as feed for livestock was taken up here in Czechoslovakia back at the beginning of the 60's, being the first in the world. We selected this method of disposition because it seemed to us the most effective utilization of all those valuable substances that are still concealed within poultry excrement in considerable measure. On our recommendation, drying chambers for the droppings were built here at large poultry farms even then. But after 1970, when energy costs increased,

the drying of poultry dung had become uneconomical. And so the feed program ended.

[Question] You mentioned the high content of valuable substances in poultry dung. What are these?

Vladimir Peter: Poultry droppings are not at all undesirable wastes as often appears to be the case. After all, after being dried they still contain an average of about 30 percent nitrogenous substances. That is more than in dried alfalfa. They also contain a large amount of mineral substances and trace elements such as zinc, manganese and iron which are often deficient in feeds. Poultry dung has a high vitamin content, especially the B group, mostly B-12. When we were experimenting with dried poultry dung back in 1960-62, we found it sufficed to add 5 percent to it to the feed mix for broiling chickens and this covered the total requirement of this vitamin for baby chicks. Nor is the high content of vitamins A and E negligible. From all this, it was evident that we ought to look into the possibility of using poultry droppings in place of soybean extracted grits which we are importing in large quantities from capitalist countries for foreign exchange. And this opportunity still presents itself today.

[Question] Of course, today we have to consider the energy situation and look for some other method than that used 20 years ago--so, some other technology for its treatment.

Vladimir Peter: We are fully aware of that. Under present conditions, it became evident that the cheapest and at the same time most efficient form of disposition, or better said, treatment of poultry dung and poultry litter was ensilage together with corn or other bulk fodder. Eng Huba is working on this problem.

Jozef Huba: I would like to add that corn compensates for those substances which are lacking in poultry dung. Poultry dung, as Docent Peter stated, has a relatively high content of nitrogenous matter which is indispensable for beef cattle production. But it has relatively low energy value, as opposed to corn which is relatively high in it. In our experiments, we are trying to find the optimal proportion of corn to poultry dung, or, in essence, between energy value and nitrogenous matter. Then we ensilage this mixture, that is, induce fermentation without access to air. What we want is to find the best method of ensiling.

[Question] The dung, as such, however, contains, besides the nutritive elements mentioned by Docent Peter, also a quantity of various bacteria which might harm the cattle.

Jozef Huba: The results of tests have shown that by following proper procedures of ensilage all disease-producing bacteria are definitely destroyed. There is a certain problem in the onset of certain kinds of molds but we detected their presence only on the surface layers which also occurs in standard ensilage in current use. It suffices to remove 10 to 15 centimeters of the top layer and underneath everything is all right.

[Question] And what is the quality of this kind of silage?

Jozef Huba: Samples of silage composed of chopped corn and poultry dung or poultry litter have been found by the State Veterinary Institute to be harmless to the health in all respects. Under the point system, most of the silage was classified as first quality. In feeding tests with this type of silage, cattle for fattening showed moderate weight increases.

[Question] Your objective, obviously, is to have the results of the testing program put into practice as soon as possible after its completion. Would you be able to say, at this point, what would be the savings and the effect on our national economy by using feed with poultry dung?

Vladimir Peter: The annual production of nitrogen agents from poultry dung represents 300,000 to 400,000 tons annually here in Czechoslovakia. If we were to take out only one-third of this for feeding beef cattle it would replace so much bulk fodder that we could free some 10,000 hectares of land to permit cultivation of such crops as soybeans or various legumes for direct human consumption. We would thereby significantly contribute to self-sufficiency in food production. At present, agricultural production is reaching a state in which animals are competing with man. We are using a large part of our land to produce fodder. Arable land should be used primarily to grow crops for people.

[Question] All the more so since today's knowledge actually makes it possible to replace fodder proteins grown on land by nontraditional proteins such as poultry dung.

Vladimir Peter: Yes. Just as a matter of interest, if, according to calculations, we were to utilize all nontraditional raw materials with nutritive content to feed farm animals we would save 400,000 to 800,000 hectares of arable land here in Czechoslovakia. After all, poultry dung need not be the only source of feed for livestock. There is also the waste from meat processing and other animal production. Dead animals, waste material from leather working, proteins produced by nicro-organisims or even larvae of household flies which, after drying, make suitable feed, fully equal to soybean extracted grits.

> Many of these sources of feed sound quite unusual to us now. But we must realize that conditions for the production of food are considerably different from those of several decades ago. And if we do not want animals to compete with us in food consumption we must make use of those feeds for their sustenance that are not sources of food for humans. Of course, this calls not only for better application in practice of the findings of science and technology but also changing our attitude toward livestock nourishment, and getting rid of traditional customs. And we should also change our notion that proper farm animals worthy of consideration as food are only the large animals. In fact, the animals that convert feed

into protein most advantageously are neither beef cattle, nor hogs, but broiling chickens. One of the main tasks of all humanity is to eliminate the conflict and competition between man and beast. We would thereby eliminate the shortage of land, the need to import protein feeds and we would assure self-sufficiency in food from our own resources and thereby the main objective charged to the agricultural and food industry complex by the 16th CPCZ Congress would be met.

8491
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BRIEFS

ELECTRONIC ACUPUNCTURE APPARATUS POPULAR--A new portable electronic acupuncture apparatus Stimul 3 was recently exhibited at the 13th Brno Trade Fair Consumer Goods Exhibition. The apparatus which is produced by Tesla Eltos enterprise in Liberec has no traditional acupuncture needles, weighs 250 g, operates on a 9-Volt battery and costs Kcs 900. The plant expects to produce about 30,000 units during 1982, but orders from Great Britain alone have reached 100,000. Stimul 3 reportedly alleviates several medical problems, among these toothache, migraine, pains attributed to rheumatism and colds, gall-bladder attacks, spinal pain, insomnia and constipation. The General Manager of Tesla Eltos Liberec M. Sevcik gave his testimony on effectiveness of Stimul 3 saying: "Only God knows how many treatments I took for my spinal problem and what an incredible amount of medicines I took. But I feel like a newborn after the electronic accupuncture treatment." [Prague SVOBODNE SLOVO in Czech 30 Apr 82 p 4]

CSO: 2402/49

COMPUTER SYSTEM DEVELOPMENT, INDUSTRIAL APPLICATIONS VIEWED

Bucharest MAGAZIN in Romanian 27 Feb 82 pp 1, 2

[Article by Mihail Florescu, secretary of state minister, National Council for Science and Technology]

[Text] The accelerated development of the Romanian economy depends on the qualitative improvement in economic activity as a whole, and on greater economic efficiency in all sectors of material production, through automation, and robotization, of technical processes, improved management, as well as the introduction and application of computer methods and techniques, and of data processing and computer technology, an area in which computers play an important role.

If the fundamental feature of the technical and scientific revolution is automation, which controls the operation and self-regulation of installations, and if the computer is the heart of automation processes, then it can be categorically stated that modern development as a whole is moving toward the generalized introduction of computers in all areas of technologic, economic, and social activities.

Computers are universal machines capable of automating a mill, analyzing ancient texts, translating, and so on. The use of digital techniques, microprocessors, and computer technology to process and transmit data, will fundamentally change the concept of automation systems, heralding new, unconventional systems of automation applications, such as: conventional man-machine systems, systems for information automation and transmission using lasers and optical fibers, automation systems for exploiting new sources of energy, and so on.

Through automation, the human functions of effort, observation, memory, and decision, needed to direct a group of operations, are replaced with the functions of technologic devices which perform the same role by technical means, on the basis of previously established, fixed programs. For instance, the development of the first Romanian process computer, the Felix C-32 P, has led to automatic process control systems. The first system was installed at the Hoghiz Cement Factory. Other systems were subsequently installed in cement factories, thermal generation plants, petrochemical installations, and so on.

The technology of the machine building industry, requiring a large number of installations and equipment scattered over large areas, involves the use of a centralized control and monitoring system by means of process computers, which collect, store, and process production information.

Recently, in the chemical industry, at the Craiova Combine for Chemical Fertilizers, the facilities which produce ammonia from methane have used structured systems for technical process management, the M-100 P and M-40 P. The computer system consists of an Independent-100 (256 Kbytes) minicomputer, four ECAROM-800 devices (with integrated microprocessors), and six alphanumeric displays controlled by their own microprocessors.

The economic results obtained from maintaining maximum synthesis yield for the ammonia, and from controlling the purge rate in the ammonia synthesis section, are manifested in a 3 percent increase in the annual capacity of each installation, with reduced consumptions of raw materials and energy.

The main functions of process computers in cement factories are: centralized monitoring of major technical parameters, periodic processsing of information obtained from raw material loads, raw material analysis, periodic calculation of raw material loads to obtain the desired quality of mixtures (cement powder), and so on. On the basis of this information, the process computers directly control the reference values of raw material flow regulators.

Felix C-32 process computers were also installed with 330 MW power generators, in power distribution systems, and so on. Comprehensive automation installations have also been exported to DRG (for 100 and 500 Gcal/h water boilers), Egypt (the Hamrawein Phosphate Combine), Iran (the Tabriz Tractor Factory), Pakistan (the Karachi Refinery), and so on.

Computer technology, like other advanced technologies, has undergone a sustained development with growth rates higher than those of other industrial branches. During 1980 for instance, production was four times higher than in 1975, and in accordance with the Directives of the 12th Party Congress, it will grow 2.3-2.4-fold during the 1981-1985 period. The revolution created by integrated circuits, and by microprocessors in particular, has had a considerable influence on the architecture of computers, which can be divided into four classes:

1. Microcomputers built around a microprocessor, and most recently on a single silicon wafer. They are generally incorporated into a product or system, which is routinely used without awareness of its presence;

2. Minicomputers, which are generally oriented toward a specific application;

3. Computers, from the smallest to the very largest, designed to solve a large variety of problems;

4. Supercomputers that are extremely powerful and characterized by very high computing speeds.

During the 1976-1980 five-year plan, Romania has built the FELIX 512/1024 intermediate/high capacity computer, the CORAL and INDEPENDENT-100 minicomputers, the FELIX MC 8/80 minicomputer, and so on.

The field's orientation for the 1981 five-year plan takes into consideration the progress of computers throughout the world, and the extensive applications of computers for raising labor productivity, optimizing energy balances, saving raw and other materials, and so on. The following directions will be followed: a new generation of computers, the FELIX C-8000 series, will be introduced; the minicomputer family will be expanded with three new types of high productivity devices; microcomputer configurations will be diversified by orienting and incorporating their applications into a wide range of industrial products and complex installations; office and pocket calculators will be added; data collection and entry will be increasigly shifted to magnetic supports, gradually replacing paper and electromechanical devices; billing and accounting machines will be of modular construction with microprocessors and a new technology; and so on.

Plans exist for a more extensive introduction of computer technology in industrial production, keeping in mind Nicolae Ceausescu's indications to the workshop of computer specialists. This will be aimed at optimum management and efficient control of production (primary data collection and processing, manufacturing in optimum batches, control of stocks and specific consumptions); numerical control of machine-tools; automatic tracing and cutting in various industries; computer-aided design; and so on.

Similar plans are made to introduce Romanian computer technology in the service sector. For instance, electronic devices will be used for inventory and cash in stores, restaurants, hotels, the Savings and Loan Bank, and for tourism and transportation rerervations. During 1981-1985, 97 percent of the country's computer technology installations will use domestic-production equipment.

World research is aimed at the production of computers that are easier to use, such as those programmed in conversational languages rather than computer and compiler ones. Also being sought are voice or written--or both--computer outputs. These achievements will make it possible to extend the use of computers to users without special training. In software, systems are being designed which will be capable of recognizing alphanumeric characters or the meaning of some sentences, and which will obey the commands of users.

Magnetic bubble memories are a promising development for reducing the size and increasing the capacity of memories. After the announcement of this discovery by Bell Laboratories in 1967, research carried out in various countries has been aimed at greater integration and higher memory capacities, while reducing the diameter of the magnetic bubbles.

The broad scale introduction of programmed-control machines has created a contradiction between the possibilities raised by automation devices and the characteristics of apparently simple operations which are now being performed by man (loading and unloading, transportation between operations, painting, welding, and so on). To resolve this newly created situation, research has produced industrial

robots, which today have penetrated deeply into industry and have become diversified over several generations. The latest types of robots are equipped with a great variety of sensors which can detect light, pressure differences, torques, and so on. Robots are controlled with microcomputers and microprocessors, and can recognize parts during assembly, select some of them, and within certain limits, carry out assembly, dismantling, and mounting.

In the words of Professor Mihai Draganescu: "Robots are articulated manipulators (artificial arms) + sensors + programs + computers." ("The Second Industrial Revolution," p 33).

Industrial robots are automatic handling devices with universal applications; they have several degrees of freedom and can perform motions that are mutually independent under synchronous control. They can be powered hydraulically, pneumatically, or electrically. Robots are programmed by memorizing successive positions initially performed by an operator, and called "learning." In this form of control they do not require a special language, which considerably reduces the dimensions of the control equipment and does not require specially qualified personnel. The Bucharest Polytechnic Institute has built an industrial robot for the Semanatoarea enterprise, and one for the Tourism Bus Enterprise. The Timisoara Polytechnic Institute has built two robots for Resita ICM (Installation and Construction Enterprise) (an electric one and a pneumatic one); the Iasi Polytechnic Institute has built a hydraulically operated robot, and so on. The Central Institute for Machine Construction has built an industrial prototype for a 6.3 daN industrial robot in cartesian coordinates, and a complex configuration with a CORAL minicomputer. Work is also being carried out for a 25 daN industrial robot in cylindrical coordinates.

The trend for the next decades is toward the installation of robots in all mechanical processes, in the machine industry, in textiles, lumber, technical handling processes, raw materials, finished products, and controlled services.

On the basis of domestic efforts, computer technology will increase the economic, technical, and scientific development process in our country, keeping pace with the demands of the contemporary world.

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East Europe Report

SCIENTIFIC AFFAIRS

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EAST EUROPE REPORT
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COMPUTERIZATION OF AGRICULTURE, FOOD INDUSTRY OUTLINED

Bratislava EKONOMIKA POLNOHOSPODARSTVA in Slovak No 3, 1982 pp 134-135

[Article by Eng Jan Liska, Enterprise for Rationalized Management of Agriculture and Food Industry, Bratislava: "Possibilities of the Application of Minicomputers and Microprocessors in The Agriculture and Food Industry"]

[Text] Automated information and computation processing in agricultural and food industry organizations is performed mostly with high-performance third-generation computers, located in computer centers of the Enterprise for Rationalized Management of The Agriculture and Food Industry. The computer centers are equipped with EC 1040 and EC 1033 computers operating in the batch mode and processing with priority information concerning the entire county for the purposes of agricultural enterprises. Also, individual economic production units [VHJ] began to process information and computations for management purposes using computer technology of their own. These are, e.g., Agrokomplex VHJ, Agricultural Supply and Purchase, Slovosivo, Machine and Tractor Stations and Agricultural Machinery Repair Shops, Milling and Bakery Industry, Viniculture Enterprises, Liko, Czechoslovak Tobacco Industry and other.

At present there is a need to switch to distributed information processing using smaller computer systems. Therefore, the electronic industry is preparing the manufacture and supply of minicompter and microprocessor systems for the economic production management and for the control of technological processes in individual areas.

Application of Small Electronic Computers in the Basic Production Agricultural Enterprises with the Automated Control System (ASR)

For one-third of the basic agricultural production enterprises in Slovakia the ASR subsystems are processed in high-performance EC 1040 computers according to a uniform project facilitating processing of enterprise information for all enterprises in the county as well as the aggregation of information for the needs of the county agricultural administrations.

In the Seventh Five-Year Plan, information will continue being processed in EC 1040 and EC 1033 computers for entire counties, while minicomputers and microprocessors of the Small Electronic Computer System (SMEP) will be applied to:
--preparation and preprocessing and transfer of data (PPPD) to master computers;

--data processing for enterprise organizational wholes;
--creating a network of cooperating SMEP minicomputers;
--control of manufacture and technological processes by minicomputers and microprocessors.

It is expected that the data will be prepared on perforated tape, magnetic cassette, standard magnetic tape and floppy disk. Minicomputers and microprocessors will be employed in the process of media formation for a medium-size computer, to which, at the beginning, perforated and magnetic tapes or disks will be transported to be processed. In the future, depending on the capacities of the telecommunication network and modulation and demodulation equipment, data will be sent to the computer center through telecommunication lines and the processed results will be sent from the computer to a printer controlled by a minicomputer.

For counties not connected to the ASR processing subsystem high-performance computers, and in 1981 two-thirds of the agricultural counties in Slovakia were not connected to these computers, SMEP computers are considered to be used by small organizational groups of enterprises or for large enterprises with several facilities. This will also solve the substitution of the present DP 100 punch-card computers. In this case, there are three types of input:
--through CRT terminals,with alphametric keyboards; for short and, later, also long distances;
--paper or magnetic media;
--photosensing marks using the OCR [character on/off-line correction] equipment.

Information can be processed in data files or by building data bases for specific purposes; gradually there will be transition toward an integrated information system for the purposes of operative and conceptual management in enterprises. Minicomputers will serve their own users and, at the same time, they will provide media for a master high-performance computer, such as SM 5211, at the level of county agricultural administration or other intermediate management link. These minicomputers can be connected horizontally into the computer center network and vertically they can be connected to a more powerful master computer. The program design of the network data communication connection is called SYRPOS--computer network control system.

Supplemented by measuring regulation equipment, the minicomputers and microprocessors developed as part of AMEP I and SMEP II can be used to control suitable manufacture and technological processes, for instance, in the manufacture of granulated fodder, in drying and air-conditioning processes, in large stables, transport line control, in warehouses etc. SM 5310 minicomputers and SM 50/40 and SM 50/50 microprocessors can be combined into distributed control systems in extensive production wholes.

Application of Small Electronic Computers in ASR in County and Kraj Agricultural Administrations.

In the second half of the Seventh Five-Year Plan, computer systems built up of minicomputers and microcomputers of the 3.5 generation will permit forming

and using medium-performance systems for economic mathematical calculations and processing of information aggregated from the enterprise systems based on the automated data bank principle.

Under local conditions, these systems will allow operation with several terminals in the question-answer mode using classic inputs and outputs to printers, microfiche technique, or graphic output equipment.

These systems will also permit combination with radiocommunication and telex systems as well as remote processing of data obtained as some specific information on an area studied within a county or VHJ, for instance, in dealing with transportation problems, in operational control, in cooperation actions aiming at the coordination of the utilization of labor force, material, power and fuels, in the control of the use and transportation of agricultural machinery during seasonal work or in dealing with the situation in animal and plant production, in particular types of services and areas of the food industry and in dealing with damage caused by climate calamities.

Application of AMEP Computers in the ASR of the Services VHJ

In Slovosivo, a scientific manufacture association for seeds and cultivation, minicomputers will be used in accordance with the function of the scientific manufacture association organizations:

--in evaluating research assignments on experimental cultivation of grain, sugar beet, corn and potatoes;
--in processing the purchase-sale activities of seed enterprises within a kraj, primarily in purification, purchase and sale of seed and seedlings, including billing;
--in seed enterprises in processing automated systems for agricultural production.

State breeding enterprises can employ microcomputers in preprocessing data, in some scientific technical and mathematical calculations and later even in the area of economic information processing.

A SM 4-20 minicomputer will be installed at the Permanent National Agricultural Exhibition Farm, Agrokomplex, in Nitra in 1984. It will serve to test automated systems of plant production operational management and enterprise management as related to the management of the entire FHJ and other problems. The minicomputers will serve as a basis for building kraj pack/unpack facilities, where background documentation will be prepared to be processed for the entire VHJ.

Mini-and microcomputer systems should serve as data concentrators for operative information processing and for building ASR's in individual enterprises of the Agricultural Supply and Purchase VHJ.

Application of SMEP Computers in Food Industry ASR's

In the Slovak food industry, several VHJ's began using small computers as early as in the Sixth Five-Year Plan. These were:

--EC 1010 small computer in the poultry industry;
--MERA 305, CELLATRON and ROBOTRON 1840 office minicomputers in distilling and preserving industries;
--MERA 305 in the tobacco industry;
--RPR 16 control computer in the sugar industry.

During the time when solutions for these applications were sought, teams of designers first formed in the area of processing information on production and economic activities and partly also in the area of technological process control. Thus the first technical basis for computer operations was created.

Further development in the application of small electronic computer systems in the food industry will concentrate on the control of production economic activities and manufacturing and technological processes.

In 1981, the meat industry bought a powerful NCR 8270 minicomputer for the needs the West Slovakia Meat Industry, National Enterprise, in Bratislava, which will be located in Nitra and will be connected to a modular terminal system with NCR 3280 microcomputers in the facilities in Nitra, Levice, Nove Zamky and the general Directorate in Bratislava. From 1981, this computer system will be used to solve production ASR's designed for operational control of manufacture, livestock purchase, material and technical supplies, the control of technical preparation of manufacture and data bases on the levels of operation of farm and factory, and enterprise, with regard to the requirements for information for General Directorate.

In the milling and bakery industry, automated manufacture control in food industry enterprises based on the data bank principle should be solved and tested with the SM 4-20 minicomputer, beginning in 1982. Also, the connection of the minicomputer to a high-performance computer located in a VHJ should be solved.

In the sugar industry, we will be able to extend the application of control minicomputer systems employed in technological stations (nodal points), making use of the experience with the RPP 16 computer and SM 50/50 microcomputer in Juhocukor Dunajska Streda, National Enterprise, and other sugar factories in Sladkovicov, Rimavska Sobota and the Bakery in Sered.

Distilling and preserving industries will test the SMEP control micro-and minicomputer systems in:
--the manufacture of yeast;
--the air-conditioning of fermenting rooms by an electronic system for measuring nonelectric quantities;
--the automated control of experimental starch fermenters using a table calculator.

The tobacco industry will also continue employing minicomputers in production-economical activities and the application of minicomputers in the control of manufacturing processes is also being prepared.

SM 4-20 minicomputers will be used in the dairy industry to manage production-economical activities and ADT 4500's will be used to control dairy manufacturing processes.

Application of Small Electronic Computers in Project Institutes

According to the "Plan to Equip Project Facilities with Computer Technology", worked out by the Federal Ministry for Development of Technology and Investments in 1980, the Plan for the Agriculture and Food Industry (11 September 1980) calls for building a main computer center in the Land Economy Project Institute in Bratislava. At the end of the Seventh Five-Year Plan, this main computer center should be equipped with a Czechoslovak high-performance computer, permitting the application of the national model ASR designs in project activities to the conditions of the Land Economy Project Institute and Potravinoprojekt, or to other project solutions in this area.

Application of Small Electronic Computers in the Area of Central Control and the Scientific Research Basis

A high-performance EC 1055 computer with the possibility of connecting several SM 4-20 computers is planned for the central level of management and for scientific research basis of the agricultural sector for 1983. The connection was tested in terms of both operation and program in the first half of 1981. These minicomputers will serve as equipment for preparation and preprocessing of data for large computer systems and for processing independent small problems.

Since the application of mini- and microcomputer systems is very demanding, it is performed as an assignment of applied research as well as directly in enterprises. A uniform methodological basis for building ASR's is being elaborated in order to facilitate mastering of this process and a complex training program in mini- and microcomputer techniques is being prepared.

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REMOTE DATA PROCESSING WITH THE K 1600 MICROCOMPUTER

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 19, No 3, Mar 82 pp 8-11

[Article by Lothar Damme and Dr Klaus Hamann, VEB Robotron ZFT (Center for Research and Technology), Dresden: "Remote Data Processing With the K 1600." Translations of the articles by Gruenewald, cited in footnote 1, and by Rossberg, cited in footnote 2, are published in JPRS 79079, 28 Sep 81 No 716 of this series, pages 15-26 and 36-48, respectively]

[Text] The development of minicomputers on the basis of microprocessors and their high efficiency is also resulting in new possibilities for establishing remote data processing systems.

For the Robotron K 1600 microcomputer system (MCS) a remote data processing (RDP) design was developed which permits both the assembly of autonomous minicomputer RDP systems and their integration into the ESER [uniform electronic data processing system] RDP systems.

Connecting terminals of the "Decentralized Data Technology" product program of the Robotron Combine VEB to the K 1600 microcomputer system can be done via serial peripheral controls or via line control units (Robotron K 8523 multiplexor and Robotron K 8521 concentrator).

Remote coupling of the K 1600 MCS with an ESER EDP system is being realized.

In all the comprehensive applications being planned the MOOS 1600 operating system is used which is being expanded by program components in order to realize tasks typical of RDP.

List of Abbreviations:

AP	User Program (UP)
AIS	Serial peripheral control
CTC	Counter timer circuit
DFV	Remote data processing (RDP)
DMA	Direct memory access
FS-Netz	Teletype network
GDN	Direct current data transmission with low transmission level
KE	Coupling unit
KON	Concentrator (CON)
MK-Bus	Multicomputer coupling bus
MODEM	Modulator/demodulator
MPD4	Multiplexor for data transmission in the ESER RDP system
MRS K 1600	Microcomputer system Robotron K 1600
MUX	Multiplexor
SDA	Serial data adapter
SIO	Serial input/output
STE	Plug-in unit
SUL	Software

1. System Structure

1.1 Overview

The K 1600 microcomputer (Robotron K 1620/Robotron K 1630) provides the control core of the RDP system (Illustration 1). All equipment planned for the K 1600 MCS can be used as peripheral equipment. When connecting a few terminals (standard value n = 4) their linkage with the K 1600 can be accomplished via serial peripheral controls (AIS) K 8060. Four lines can be connected to an AIS. Since in the case of character interrupt-controlled data transmission between the K 1600 and the AIS the central unit is heavily loaded, it is necessary to use one or several multiplexors (MUX) when there is a large number of terminals and/or high rates of data transmission (maximum load for K 1600: 3-4 K bytes/sec ≙ 4 lines at 9,600 bauds in half-duplex and continuous operation).

In this way the central unit of the K 1600 is relieved of direct input/output and is available for processing tasks. Procedure control and operation of the interfaces is done in the multiplexor.

On-line coupling to the ESER EDP system (via MPD 4 [multiplexor for data transmission in the ESER EDP system] and the terminal control computers, respectively) is likewise realized by means of the multiplexor in the K 1600. Whether one of the 16 terminal connections of an MUX or one MUX with only one (fast) line is used for this coupling depends on the required speed of data transmission.

In place of a terminal a concentrator (CON) can also be connected in. Of the 16 terminals of the CON 1 is required for coupling to the MUX. The remaining 15 are available for connecting additional terminals.

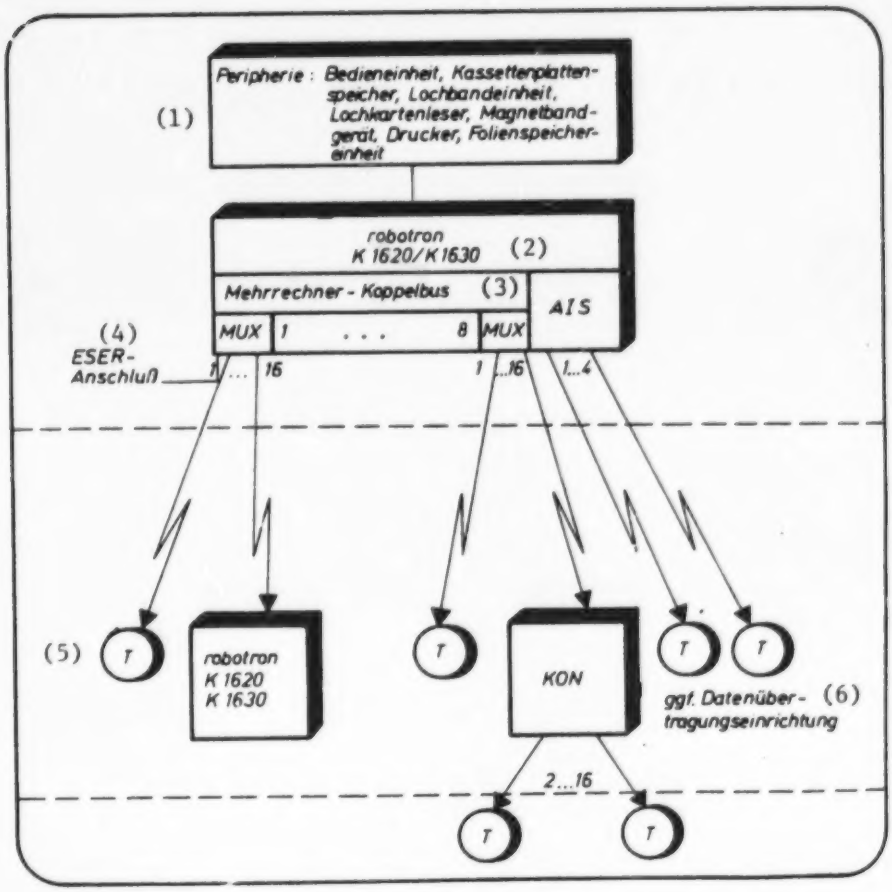


Illustration 1. RDP with the Robotron K 1600 MCS

Key:

1. Peripheral equipment: operating unit, cassette disk storage, perforated tape unit, card reader, magnetic tape device, printer, film storage unit
2. Robotron K 1620/K 1630
3. Multicomputer coupling bus
4. ESER connection
5. Terminal
6. Data transmission device, as needed

Remote coupling of two K 1600 computers is also possible via multiplexors.

The terminals which are provided for connecting to the K 1600 are shown in Table 1. Connection with the K 1600 is done via point-to-point links or multipoint links, with or without data transmission devices, in half-duplex or duplex operation. Which of these kinds of linkage is used depends on the available lines and data transmission devices, on the coupling procedure and the terminals to be connected.

Table 1. Terminals of the RDP System on the Basis of Robotron K 1600

Designation	Control core	Operating system	Terminal image	Procedure
Office computer A 5110 Office computer A 5120 Office computer A 5130	K 2526	SIOS 1526 [*]	IFSS, V 24	AP 62/64, BSC, SDLC*
Display unit terminal K 8912	K 2521	Fixed program	IFSS, V 24	AP 62/64
Display unit terminal K 8914	K 2521	Fixed program	V 24	BSC
Universal display unit terminal K 8931 Bank window terminal K 8924 Printer terminal K 8951 Seat reservation terminal K 8927	K 2526	SIOS 1526	V 24, IFSS	AP 62/64, BSC, SDLC*
Teletype T51/63			V 10	FS-Procedure

*Planned for
[*] Serial Input/Output System

1.2 Equipment Components

1.2.1 K 1600 Robotron Microcomputer System

Microcomputer with 16 bit processing range, storage capacity of 28 K words (K 1620) and 124 K words with storage switching equipment and arithmetic processor (K 1630), respectively.

Peripheral equipment: Robotron K 8911 operating unit, CM 5400 cassette disk storage, CM 5300 magnetic tape equipment, Robotron K 5261 cassette magnetic tape unit, Robotron K 6200 perforated tape unit, Robotron 1152 or Robotron 1157 series printer, VT 27065 parallel printer, EC 6112 card reader, diskette drive.

KE 16 coupling unit to couple to the MK bus [multicomputer coupling bus].

1.2.2 Robotron K 8523 Multiplexor Line Control Units and Robotron K 8521 Concentrator

The basic structure of the MUX and CON is shown in Illustration 2. The MUX is a fixed program control unit in the form of a slide-in chassis in the K 1600.

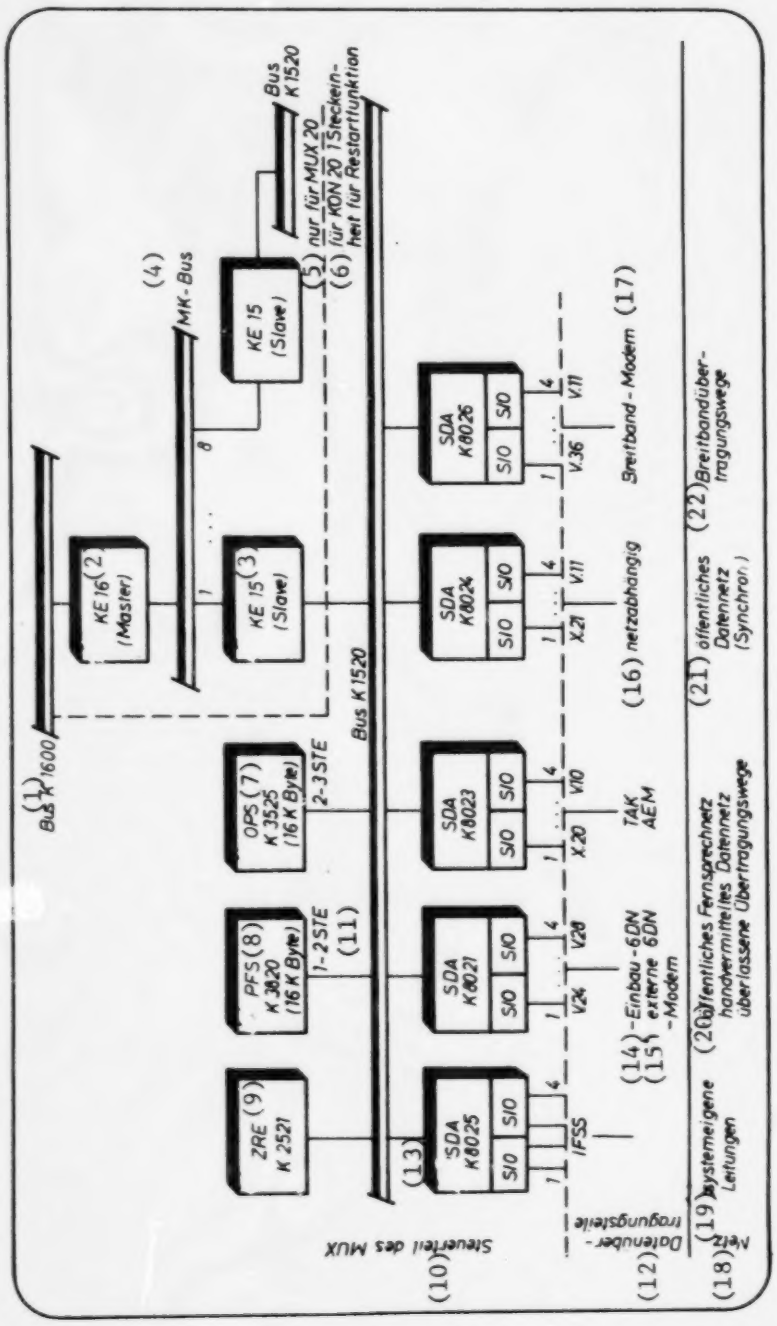


Illustration 2. Structure of the Line Control Units of Robotron K 8523/CON K 8521

[Key on following page]

Key:

1. Bus K 1600
2. Coupling unit 16 (master)
3. Coupling unit 15 (slave)
4. Multicomputer coupling bus
5. Only for MUX 20
6. For CON 20 1 plug-in unit for restart function
7. Operative storage (RAM) K 3525 (16 K bytes)
8. ROM K 3820 (16 K bytes)
9. Central computer unit
10. Control section of the MUX
11. 1-2 plug-in units
12. Data transmission sections
13. Serial data adapter
14. Installed 6 DN
15. External 6 DN
16. Network-dependent
17. Broadband-MODEM
18. Network
19. Lines in the system
20. Public telephone network; hand-switched data network; released transmission channels
21. Public data network (synchronous)
22. Broadband transmission channels

Equipping the MUX with programmable ROM and operative storage depends on the control program system generated. When used for only one data transmission procedure 16 K bytes PROM are adequate for the control program system.

The remaining address supply up to 64 K bytes is available for operative storage (RAM).

Connecting the maximum of 16 terminals is accomplished via (a maximum of 4) serial data adapters (Table 2). The serial data adapters (SDA) are supposed to adapt the K-1520 bus in parallel to the serial interfaces of the lines. The four channels of an SDA (reducible to two channels) have the same interface. Each SDA contains two SIO (serial input/output) circuits which in turn each have two I/O channels.

The SIO circuits, in addition to bit-serial reception and bit-serial transmission, take care of parity bit production and checking. Moreover, each SDA contains three counter timer circuits (CTC).

Every two lines of an SDA work at the same speed. By means of appropriate programming the SDA's can operate duplex or half-duplex, synchronously or asynchronously (exception: the IFSS interface only asynchronously). Coupling the MUX to the bus of the K 1600 is done via coupling units (2 plug-in units [STE] KE 15 in the MUX, 2 STE KE 16 in the K 1600 and multicomputer coupling bus [MK-bus]).

Table 2. Serial Data Adapter on the MUX/CON

Serial data adapter type	Interface	Maximum transmission speed (bits/sec)	Signal converter	Connection to public teletype network
K 8021	V 24/V 28	9,600	MODEM, GDN	Public telephone network, hand-switched data network, released transmission channels
K 8023	FS-X20/V 10	300	AEM/TAK	Teletype and data network, telex network, released teletype transmission channel
K 8024	X 21/V 11	48,000	Network-dependent	Teletype and date network
K 8025	IFSS	9,600	-	Line in the system
K 8026	V 36/V 11	72,000	Broadband MODEM	Broadband transmission channels

In line with the planned outfitting of the K 1600 with a maximum of eight MUX, eight KE 15 coupling units can be connected to the multicomputer coupling bus. Data transmission between MUX and K 1600 is accomplished in block manner in DMA [direct memory access] operation. The CON, in contrast to the MUX, is an independent device. Coupling unit and multicomputer coupling bus are unnecessary. The CON contains instead an STE for restart function. To operate the CON (system start, finishing test programs) one of the connected terminals is used.

1.2.3 Data Transmission Devices

Data transmission devices serve to adapt the interface to the conditions of the information channels and permit transmission of characters across great distances. In the RDP system described, MODEM's and GDN (direct current transmission with low level transmission) are used. Table 3 gives an overview of the data transmission devices planned for use.

1.2.4 Terminals

The terminals to be used in the RDP system on the basis of the K 1600 MCS are shown in Table 1.

2. K 1600 RDP Software

The RDP software for the K 1600 functions closely with the MOOS 1600 operating system. The MOOS 1600 makes possible efficient program finishing with the use of home peripheral equipment.

Table 3. Data Transmission Devices

Designation	Country of manufacture	Maximum transmission speed (bits/sec)	Interface	Transmission distance
MODEM AM 1200 (EC 8006)	Hungary	1,200	V 24	Arbitrary
MODEM TAM 601 (EC 8006)	Hungary	600/1,200	V 24	Arbitrary
GDN KATA 96 (EC 8028)	Hungary	9,600	V 24	Maximum 30 km
DNU 9600	GDR	9,600	V 24	Maximum 30 km
Broadband MODEM (planned for)	GDR	72,000	V 36	Arbitrary

At the levels of line control and information control the K 1600 RPD software supports the information exchange between user programs in the K 1600 and the remote components of the system according to Illustration 1.

The K 1600 computer does not handle the processing of tasks of line control, such as:

--time-division multiplex operation of lines;

--realizing guaranteed data transmission for various interfaces and transmission algorithms. These tasks are taken over by control programs in the MUX and CON line control units.

Organizing information traffic is done by the TCR 1600 information control program which operates with the MOOS operating system.

2.1 Control Program of the Line Control Units

The structure of the control program is characterized by two levels of priority, specifically:

--by the interrupt-controlled routines for character I/O via serial data adapters on the line side and block I/O via the multicomputer coupling bus;

--by program-controlled management routines for realizing the various transmission procedures, for analyzing control information, for starting and ending transmissions.

The RAM storage unit of the MUX is subdivided into:

--information fields for information waiting lines and line and coupling unit control blocks with constant data on the line characteristics and the actual processing level;

--dynamically managed buffer areas.

In these buffers the data and control characters, which are collected in interrupt operation in a time-division multiplex manner via the lines and evaluated in a way appropriate to the procedure, are joined together into complete information, or the complete information transmitted from the K 1600 to these buffers is outputted to the lines in divided traffic.

Filling the information fields according to the configuration of the RDP system, setting the initial values and activating the start of the control program are accomplished via the MK-bus through the K 1600 central computer.

The structure and operation of the control program of the CON are analogous to those of the MUX. The routines for block I/O via the MK-bus do not apply. The control program additionally contains an operating module. This supports communication between CON and a selected terminal. In particular, this affects the input of information to the terminals connected to the CON and the realization of start and test functions.

2.2 TCR 1600 Information Control Program

The TCR 1600 is a modularly structured program system which operates with high priority under the control of the MOEX 1600 executive system.

The basic function of the TCR 1600 consists in organizing information traffic between:

--user program (UP) of the K 1600 and the terminals;

--UP of the K 1600 and UP in an ESER EDP system or in another K 1600;

--terminals on the K 1600 and UP in an ESER EDP system.

When the system starts, the information for the RDP configuration which is to be supported must be communicated by the K 1600 operator to the TCR 1600. Then the traffic between the UP in the K 1600 and the TCR 1600 takes place by means of descriptive and executive macrostatements. These permit the programmer a similar kind of operation as in the case of interaction with home peripheral equipment.

The essential functions of the components shown in Illustration 3 indicate the performance of the TCR 1600:

Central modules

--interaction between time-sharers;

--organization of waiting lines and buffers.

Network management module

--structure and management of the actual configuration table (information on procedures, line conditions, among other things).

Start module

--setting a definite start condition;

--filling information fields in the MUX.

Operating module

--commands for starting and for test work;

--input of changes in configuration;

--output of allocation lists, error statistics.

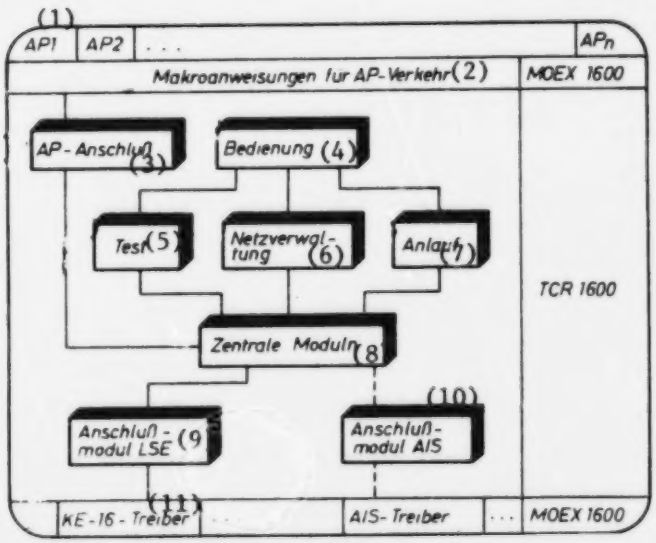
Connecting modules for application programs in the K 1600, for MUX and AIS

--realizing the connection conditions for the respective drive.

Test module

--off-line and on-line test of the equipment chain.

The KE 16 drive accomplishes the physical exchange of blocks of fixed length in the DMA sector with the MUX. When connecting terminals via AIS the tasks of line control are taken over by their drives. Interaction between AIS drive and TCR 1600 is guaranteed.



Key:

1. User program 1
2. Macrostatements for user program traffic
3. User program connection
4. Operation
5. Test
6. Network management
7. Start
8. Central modules
9. Line control unit connection module
10. AIS connection module
11. Coupling unit 16 drive

Illustration 3. Structure of the TCR 1600 Information Control Program

3. Use

It was shown that unhampered configurability and modularly structured software characterize the RDP design for the K 1600 MCS. On this basis it is possible to solve a quite varied array of use tasks which make optimal use of the efficiency of the individual components of the RDP system. Variants for the use of the K 1600 RDP software are:

Terminal-Oriented Robotron A 6421 and Robotron A 6422 Base Computer Systems

A broad assortment of terminals on the K 1600 as the central computer is used for data gathering and output primarily in the conversational mode. In the central computer a data processing program packet, which is tailor-made for the application, operates under the MOOS 1600 operating system. Typical systems are the DSS-30 data gathering system, the KSS cash collection system and the PDLS production data collecting and guidance system for discontinuous processes.

Robotron A 6401 and Robotron A 6402 Commercial Base Computer Systems, Robotron A 6491 and Robotron A 6492 Process Computer Systems

The home resources of the K 1600 MCS are used primarily to solve a technical application problem. Beyond that, there is information exchange with remotely coupled components of the overall system.

Remote terminals, for example, serve to output information about the level of processing in the central computer, about certain conditions in the process to be controlled and about interruption of the processing operation by the operating personnel. Compressed data are transmitted in a time-cyclic or event-controlled manner to a superordinated computer, another K 1600 or an ESER EDP system; after they have been evaluated, predetermined values, which control the further course in the use-application system, are retransmitted.

Remote Coupling With an ESER EDP System

By remote coupling of the K 1600 with an ESER EDP system the collection, checking and preliminary processing of data at the place of origin and the output of results of centralized ESER projects at the destination become possible. Information exchange is largely done in the form of big data batches between the respective external storage media.

Remote Coupling of Two K 1600 Microcomputers

Two K 1600 computer systems process a comprehensive set of tasks at the same time at different locations. The principles of the interaction between the computer systems as a function of the sphere of application can be quite diverse.

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CSO: 2302/1

MEDICAL ACADEMY HEAD DISCUSSES DOCTORS' TRAINING, RESEARCH

Bucharest CONTEMPORANUL in Romanian 30 Apr 82 p 4

["The Scientist and His Humanistic Responsibilities," interview with Prof Dr Constantin Arseni, by Magdalena M. Popa]

[Excerpts] Question: We know that you, Prof Dr Constantin Arseni, are the head of the neurosurgery clinic at "Gheorghe Marinescu" Hospital, the chairman of the Academy of Medical Sciences, and the chairman of the bureau of the Central Committee of the Organizations of Socialist Democracy and Unity. How do you combine these many activities, of profound responsibility?

Answer: I have always been a precise, punctual and, especially, organized person. According to a mathematical precision, I set my schedule each day. I always keep promptness in mind. No matter what the problem is, I must solve it immediately.

Question: Recently, your hospital has been supplied with ultramodern equipment and advanced therapeutical methods and new surgical techniques have been assimilated. What new results have been achieved?

Answer: At the present time we have the largest neurosurgery clinic in the world in regard to the number of beds--650. The largest clinics abroad have only 120 beds. Our equipment is very expensive, for example, the tomograph computer which photographs the brain in sections, and other equipment which determines the speed at which the blood is circulating in the brain. We take care of all branches of neurosurgery--brain tumors, cranial trauma, and, more recently, vascular surgery on the brain (we now have a special pavilion for this), with very good results.

We have constantly adopted new surgical techniques which are being used abroad. We are known as the school of neurosurgery with the richest activity in the world. We have had the intuition to devise new treatments and this makes everyone have great confidence in us. But the results we have obtained here in our country do not keep us from being informed about the results obtained abroad and about the specialization of our doctors in other medical sciences centers in the world. On the contrary, they require that we keep informed.

Question: There has been much talk about the existence of a gap between the top medical doctors who are near retirement age and the younger generation. What should be done to get rid of this gap?

Answer: Much is being said about this gap, not only in our country but also in the entire world. This is a result, perhaps, of the fact that we have not been sufficiently concerned about medical education. Much is being said about the lack of specialists, since the period of specialized training is longer. A surgeon is not made in 4 or 5 years. In my opinion, a good surgeon is trained in 10-15 years, depending on his specialty. I believe that the experience of the giants of medicine should be communicated, in an organized form, to the new generations.

Persons who want to become general practitioners should have an on-the-job training period of two years. The future doctors who do well and want to specialize should be given an examination for specialization, immediately after they finish the faculty, wihout any other training period. I propose more extensive preparation than is currently the case, followed by a difficult examination.

Question: What do you think about the intern-extern system which is no longer in effect?

Answer: I think that the intern-extern system is necessary but there are some who do not agree with me. The great doctors in Romania and in the entire world have been intern-externs.

Question: You are chairman of the Academy of Sciences which has especially important tasks in promoting new elements in scientific research. Please tell us how this academy carries out its activity to ensure that the new is promoted and no valuable idea is lost.

Answer: The purpose and role of the Academy of Medical Sciences is a single one: science. Recently, I spoke with minister [of health], Eugen Proca who told me that it takes 10 years for a drug to appear on the market and millions of hard currency lei are spent before the drug is approved. It has to be tested in 2 or 3 institutes; then it has to be submitted to the Institute for Medicines for tests in regard to the content and dosage; then experiments are conducted on animals and, later, in hospitals or clinics. Finally, the drug is put on the market. We have made some mistakes in this area but, fortunately, without repercussions. However, if anyone were to discover a cure for cancer it is certain that such a spectacular result would be promoted immediately by our scientific forum. I am convinced that, in the future, cancer will be cured by medical treatment and not by surgical treatment. This is why the Academy of Medical Sciences promotes new inventions. But something new should be viewed neither with too much enthusiasm nor with negativism. It should be studied seriously and should be documented; even some unsuccessful results can be repeated. You should not say yes or no but only observe closely and look again.

Question: Please discuss the current situation of Romanian medical science.

Answer: I will limit myself to the field with which I am concerned. We have done everything to ensure that Romanian neurosurgery occupies a place of prime importance on the international level. We publish in all the reviews in the world. In regard to experience, we have accumulated a spectacular record: more than 40,500 cranial traumas. Unfortunately, however, the theoretical progress is not always in accordance with the statistical results. Although we have interesting scientific research being conducted in the Institute of Neurology and Neurosurgery by Prof Vlad Voiculescu, a distinguished neurologist, in general, there is a gap between research and practice, a gap which must be reduced or eliminated. I believe that in the future we will have very fine results, with the assistance of the National Council for Science and Technology.

We are always publishing new works on the international level. We were the first ones in the world to compile a work of mathematical statistics in neurosurgery. However, I must stress the fact that if you want to be in science you have to publish in foreign languages, so that you will become known in the entire world or so that you will receive international approval. In this sense, I am stressing the issue of medical priorities. I had one book "Parazitii din creier" [Parasites in the Brain]. It had world-wide priority. But I wrote another one--"Endocrinoneurochirugia" [Endocrinological Neurosurgery]--which remained at the publishing house three years before it was printed; in the meantime, the Americans published something similar, three years before I did and they have priority. But I have one consolation--they publisehd fragments from articles, not a book. It would be a good idea if the Academy of Medical Sciences and the National Council of Science and Technology would determine what books constitute priorities so that they can be launched in the international sphere on time.

CSO: 2702/6

END

JPRS 80881

21 May 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 743

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RESEARCH PLAN TO INCLUDE MEDICAL BIOLOGICAL DIAGNOSTIC PREPARATIONS

Budapest NEPSZABADSAG in Hungarian 30 Apr 82 p 4

[Text] At the recommendation of the Science Policy Committee, the government has decided to include research, preparation and introduction of medical-biological diagnostic products in its medium-term R&D plan which runs from 1981-1985.

The vast achievements of research in molecular biology, biochemistry and immunology over the past decade have given medical science new tools for diagnosis and treatment of ailments. Consequently, a branch of pharmo-chemistry has sprung up in countries where medical science is well developed and where there is an appropriate pharmaceutical industry to back it up. This branch produces preparations for diagnosing and treating ailments from human and animal cells and blood plasma. The products are used primarily in treatment of infectious viral diseases, tumors, haematological and endocrinological diseases, birth and development defects and in tissue and organ transplants.

In Hungary, production of such preparations has been begun in limited quantities only, and substantial imports are needed. However, it is the general opinion that the requisite knowledge and expertise for making these products are available at home. Given target-oriented research utilization, refinement of domestic results and broader research, domestic preparations suitable for clinical use could be produced within a short period.

The new program is broken down into three subprograms: the first calls for production of special blood preparations--diagnostics, prophylactics, therapeutic preparations. The second involves evolution of so-called lipsosome preparations. In these preparations, lipids are encased in microcapsules which alter their pharmacological character and effects. They can be tagged to act in specific areas. The third subprogram is aimed at development of radioactive preparations.

The research program and the more broadly based production plans are to utilize the existing institutions of the Ministry of Health, namely, the Institute of Haematology, the National Blood Bank Enterprise, the Human Vaccine Producing and Research Institute, the Isotope Institute of the Hungarian Academy of Sciences, the regional isotope laboratory network and the operations of the pharmaceutical enterprises.

CSO: 2502/74

ONBOARD COMPUTER OF MALEV PLANES

Budapest INFORMACIO ELEKTRONIKA No 1, 82 pp 56-58

[Article by Laszlo Ujlaki: "The Onboard Navigational Computer of MALEV Planes"]

> [Text] This article allows us to become more familiar with a special application of computer technology. The application--so far as the profile of our magazine is concerned--is a border area. The article is published in view of the high level of interest, the special and interesting nature and the significance of the application. (The Editorial Staff)

The navigation of planes traveling on high-traffic routes is assured by many radio devices, which indicate the direction to be followed, the remaining distance to be covered, etc. Flying over oceans, deserts, sparsely populated areas, however, the pilot can rely only on data directly measurable on board. The processing of this information, not directly usable for navigation, is performed by the onboard navigational computer. The operation of such a piece of equipment--in service onboard MALEV planes--is described in the following.

On the most modern MALEV planes, an analog-digital-system navigational destination computer is used. Its task is to determine and display the position of the plane and assure via the guidance system that the plane stays on the designated course, especially when following routes poorly serviced by terrestial navigational aids.

The determination of the position of the plane is achieved by the real-time integration of the momentary flight speed (ground speed, or course speed, i.e., speed registered relative to the surface of the earth). The speed is sensed by the Doppler radar of the plane, and the momentary flight direction --the geographical direction of the longitudinal axis of the plane--by the guidance system of the plane; the latter is a gyrocompass corrected by a magnetic directional angle.

The navigational computer uses the so-called fractional orthodromic coordinate system. This is a right-angle system, which is usually along a

short and straignt section of the course. Axis S coincides with the course, and axis Z is perpendicular to it. The origin of the coordinate system is at the end of the course section.

Fractional orthodromy is defined by two parameters: the course angle--the angle between the given course section, i.e., axis S, and the direction of the north pole--and the length of the section.

In the example shown in Figure 1, the plane traveling from point A to point B is flying along the fractional orthodromy which may be characterized by course angle TC (true course) and distance AB; distance s and lateral drift z are its coordinates. The next course section, of course, has a different fractional orthodromy.

The navigational computer calculates the momentary coordinates of the plane based on the system of equations below:

$$s = s_o - \int_{t_i}^{t_{i+1}} w_s \, dt;$$

$$z = z_o \int_{t_i}^{t_{i+1}} w_z \, dt;$$

where:

s_o, z_o are the coordinates of the plane at initial time t_i,

w_s, w_z, and S and Z components of the course speed

and

t_i, t_{i+1}, the initial and final time of the flight completed along the i-th fractional orthodromy.

The most important navigational parameters can be seen in Figure 2.

Let us note that the direction of vector w of the course speed does not coincide with the longitudinal axis of the plane, since wind of speed vector u shifts the plane by the value of wind drift angle DA (Figure 3).

The output signal of the Doppler radar contains information relative to both course speed w and wind drift angle DA. The doppler frequency generated by the device--disregarding wind drift for the moment--is directly proportionate to the course speed:

$$f = k \cdot w,$$

where k is a constant characteristic to the device.

The determination of the distance covered by the plane can be practically reduced to pulse counting:

$$I = \int_{t_1}^{t_2} w\,dt = \int_{t_2}^{t_2} f/k\,dt - n/k,$$

where n is the pulse count of the doppler frequency during registration time $t_2 - t_1$.

In reality, the situation is more complicated. In order to take into account wind drift, the Doppler radar simultaneously generates three frequencies. Since the frequencies are proportionate to the course speed and the wind drift angle, using the model of the S and Z components of the speed, the concept of the pulse count components can be introduced by applying the similar model of the s and z components of the displacement. Finally--taking into account that the individual Doppler frequency radiation directions are different--the determination of the speed components is done based on the following system of equations:

$$w_s = k_1 (f_1 + f_2) \cos (TH - TC) + k_2 (f_2 - f_3) \sin (TH - TC);$$

$$w_z = k_1 (f_1 + f_2) \sin (TH - TC) + k_2 (f_3 - f_2) \cos (TH - TC)$$

where

k_1, k_2 are constants characteristic to the Doppler radar, TH - TC, the difference between the momentary direction angle and the course angle of the plane

and

f_1, f_2, f_3, the three Doppler frequencies.

The displacement components--i.e., the fractional orthodonic components--can be determined by its integral:

$$s = k_1 (n_1 + n_2) \cos (TH - TC) + k_2 (n_2 - n_3) \sin (TH - TC);$$

$$z = k_1 (n_1 + n_2) \sin (TH - TC) + k_2 (n_3 + n_2) \cos (TH - TC),$$

where n_1, n_2, n_3 are the numbers of three Doppler frequency pulses during the time of registration.

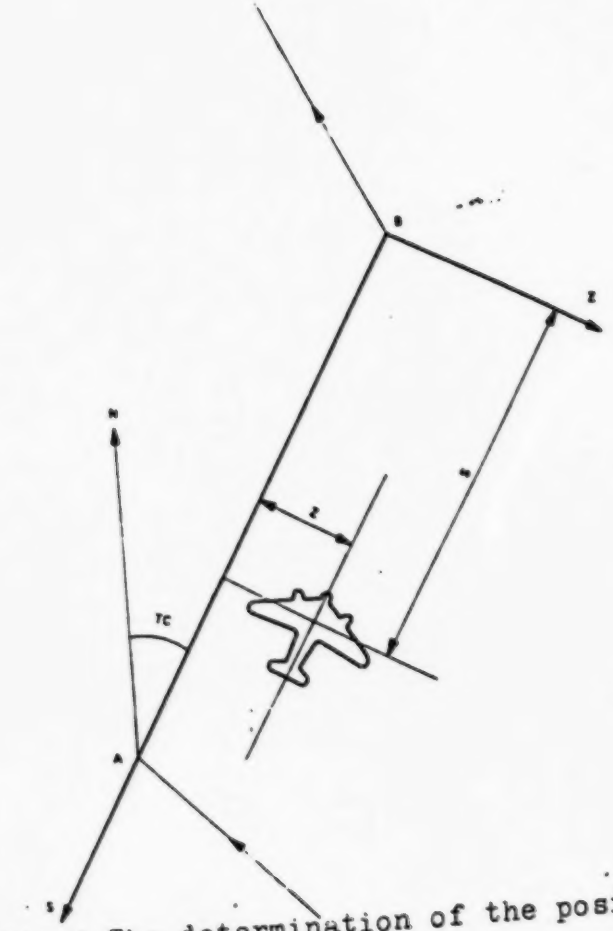
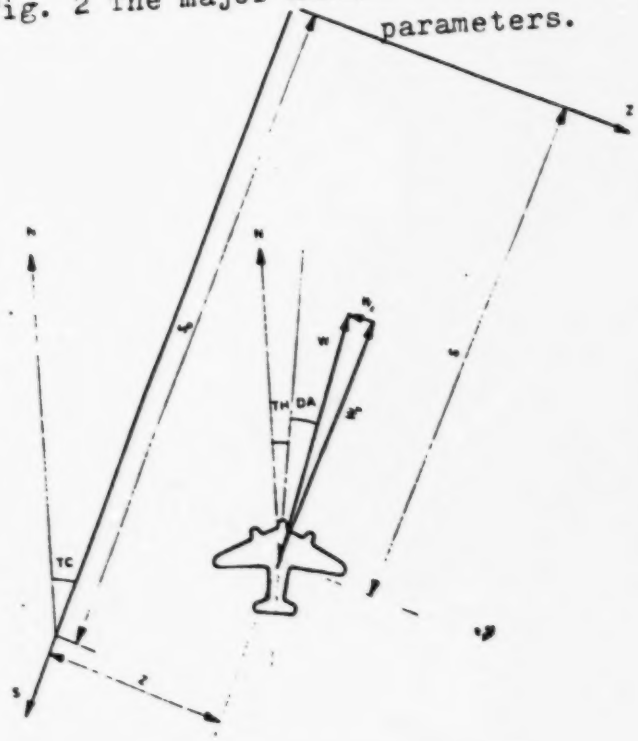


Fig. 1 The determination of the position of the plane in the orthodromic coordinate system.

Fig. 2 The major navigational parameters.



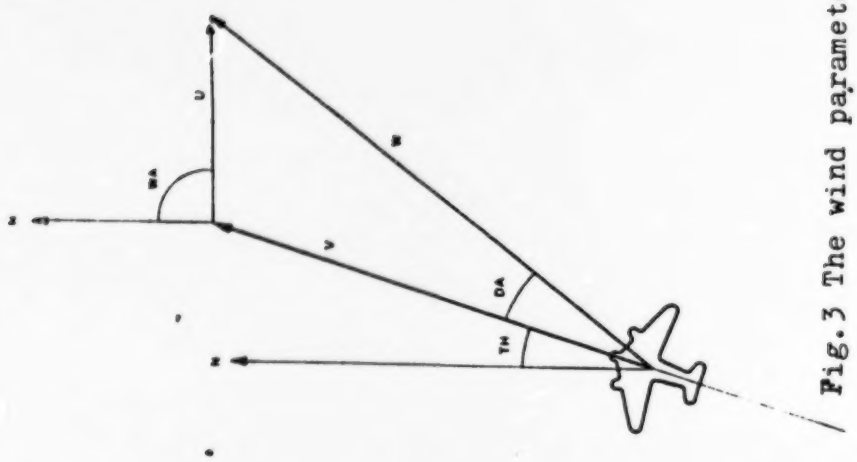


Fig.3 The wind parameters.

Course angle TC set on the instrument panel of the navigational computer and direction angle TH coming from the guidance system are processed as analog signals by the equipment; the two signals are accepted by alternating-current servocircuits.

The sine and cosine values of the analog signal are produced by revolving transformers.

The alternating-current sine and cosine signals are converted to digital code by an A/D converter. The multiplication of the Doppler frequency by the sine and cosine values is performed by a pulse multiplier. The pulses are counted and summed up by stepping motors. This design assures information protection even in case of power failure. Via a corresponding reducer, the axle of the stepping motors drive a counter which displays the momentary values of coordinates s and z in kilometers.

The equipment contains two identically built computer units. One is always active calculating and indicating the momentary coordinate; in the meantime, on the other unit, the parameters of the next fractional orthodromy can be set by means of the operating organ.

When the value of coordinate s, displayed by the active unit, is approximately zero, the equipment automatically reverses the role of the units: the hitherto passive unit becomes active and continues the calculation of the coordinates. It accepts as an initial value the value displayed by the other unit at the instant of the switchover, after recomputing it according to its own fractional orthodromy. The other unit is freed and the next fractional orthodromy may be set on it.

The value of the distance causing the switchover can be programmed in advance (we shall immediately see the importance of this). The switchover can be effected by an emergency switch any time.

The equipment--in addition to its function as an indicator--can also be used for the direct control of the plane. Lateral drift z and its first derivative transmitted as an analog signal (direct voltage) by the equipment is fed to the input of the automatic control system (commonly, but inaccurately, known as the automatic pilot) of the plane. In its corresponding operating mode, the automatic control system performs a maneuver to reduce the value of coordinate z, by manipulating the rudder surfaces of the plane.

When the orthodromic distance is properly selected, the plane assumes its new course section with a mild turn.

The operation described above is that of the basic operating mode. Navigational computers, however, have an emergency operating mode: because under certain circumstances (especially while the plane is maneuvering), the Doppler radar does not supply reliable information. In such a case, it generates an inhibit signal which is used by the navigational computer to set the emergency operating mode.

The typical feature of this emergency operating mode is that it uses the information recorded prior to the moment of its activation. The navigational computer continuously receives information on the true air speed of the plane; this is the properly corrected speed of the movement of the plane relative to the surrounding air mass, measured by aerodynamic methods. Comparing the values of the true air speed to the signal of the directional system and the signal of the Doppler radar, speed u of the wind and the direction of wind angle (WA) can be determined (Figure 3). These two parameters are recorded by the analog storage at the instant when the switchover to the emergency operating mode occurred--reversing the former method--the missing information of the Doppler radar can be determined. Thus position determination can continue. In the emergency operating mode, of course, it is not possible to take into account the changes of the wind parameter in time and space; as a result, accuracy is reduced.

When the navigational computer is used, the length and course angle of each course section must be established based on air navigation charts during the preparation phase of the flight.

Prior to takeoff, the navigational personnel sets the parameters of the first two course sections. Following takeoff, the computation can be activated by the hitherto frozen parameters when flying over the starting point of the first section. After changing over to the second course section, the parameters of the third section can be set, and so on.

In some designs of navigational computers, the calculated coordinates can be modified based on the signals of the radio navigation system. This is important when the plane is flying outside the effective range of terrestial radio navigation aids for a long period of time. In this case, the mistakes accumulated during the integrations taking place over the long time period can be eliminated.

In closing, let us note that technical advancements are manifested in this area as well: on the next generation of planes, a fully digital-system navigational computer is used, which, among other things, allows the programming of the entire course in advance.

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CSO: 2502/69

PROCESS - 2000 VIDEOTON NETWORK SYSTEM DESCRIBED

Budapest INFORMACIO ELEKTRONIKA in Hungarian No 6, 81 pp 335-337

[Article by Zsigmond Racz, instructor at SZAMOK [Computer Technology Training Center], and Istvan Simon, staff scientist at SZAMKI [Computer Technology Research Institute]

[Text] Our paper describes the communication-control operating system of a packet switching network. It describes the conditions of realization, the system environment, and the currently operating realization of the PROCESS-200 operating system. The first part of the paper describes general considerations; thus it is likely to be of interest to a relatively broad circle of computer-technology experts. The second part, containing information concerning details of the realization, is recommended for practitioners of operating systems.

(Manuscript received 1 March 1981)

PROCESS-2000 is the operating system of the nodal-point computers of the Videoton Network System (VNS), developed jointly by Videoton and SZAMKI. The VNS, the separate message-packet switched system of Videoton, can be divided into two main parts, namely the application environment and the communications environment.

The following are the tasks of PROCESS-2000:

- Clocking the independent processes of the communications environment;
- Solving the coordination problems resulting from concurrent cooperation;
- Clocking the resources;
- Handling the series related to message handling; and
- Ensuring the effective operation of the entire communications subnetwork (Network System Support - NSS).

In developing the operating system, we started from the standard Videoton monitor RTDM. We made certain changes but retained its input, output, and clocking system, as well as certain monitoring program sectors and immediate tasks which are essential for the operation of the system.

For the operating system we received the DTM60 periphery handler from Videoton. This handler physically handles the AMC and the asynchronous lines. The VTDLC periphery handler handles the synchronous lines which connect the individual nodal-point computers. This handler was also developed by Videoton. The VTDLC, same as other layers of the NSS, were inserted into the PROCESS-2000 operating system as immediate tasks at generation. A special momitoring program sector, inserting and monitoring the programs, supported the work of the network developers. The Structured Macro Set (SMS), which is based on the macroassembler of the VT60 and which was developed by staff members of SZAMKI, made the designing convenient and contributed to the effectiveness of the insertion.

General Description of the VNS

The VNS is a network of Videoton. Its aim is to support the divided resource management system of the enterprise. The following are the components of the resource management system:

- Handling the parts catalog;
- Handling the orders;
- Programming the manufacture; and
- Handling the warehouse stock.

Because of the divided character of the system, the data-processing functions are connected by a data-communication function. Accordingly, the VNS system can be divided into two main parts: the application subsystem and the communications subsystem.

Videoton developed the application system which performs the above functions. The communications subsystem was developed jointly by Videoton and SZAMKI.

The physical network consists of ESER 1010, ESER 1012, or ESER 1010M (VT60) type data-processing computers, which are located away from each other, and the ESER 1010M computers, which represent a communications subsystem providing intercommunication between them. The host-node connection is via AMC; the node-node connection is realized over 9600 bit/sec synchronous lines. The interactive VDT terminals are connected to the nodal points via 600/1200 bit/sec asynchronous lines.

Figure 1 illustrates the hardware/software architecture of the VNS. The VNS is amessage-packet switched network of layered design, following the recommendations of the Open Structure Architecture. The layer layout is shown in Fig. 2.

Numerous documents and publications are already available on the operation of the VNS network and the individual layers. The most important ones are listed in the bibliography.

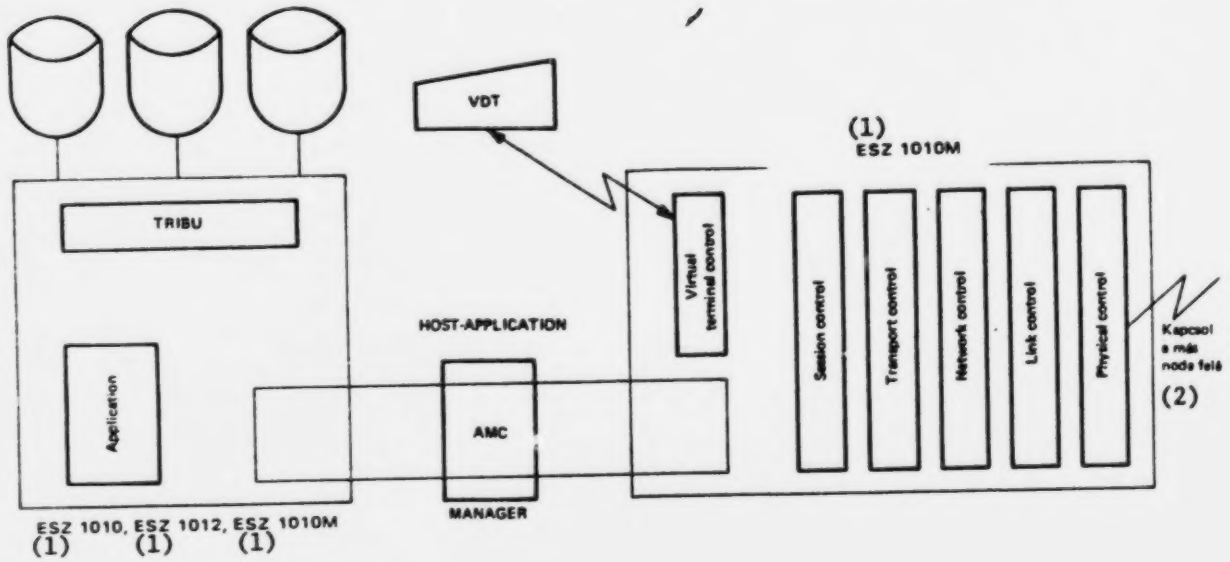

Fig. 1. The layered structure of the VNS

Key: 1. ESER
2. Switches to other node

The VT60 (ESER 1010M) Computer

Architecture

The VT60 computer is the small computer of Videoton, compatible with ESER 1010/ESER 1012.
Its memory capacity is 64 kbyte for programs and, selectably, 64 kbyte for data.
Its word length is 16 bits plus a memory-protection bit.

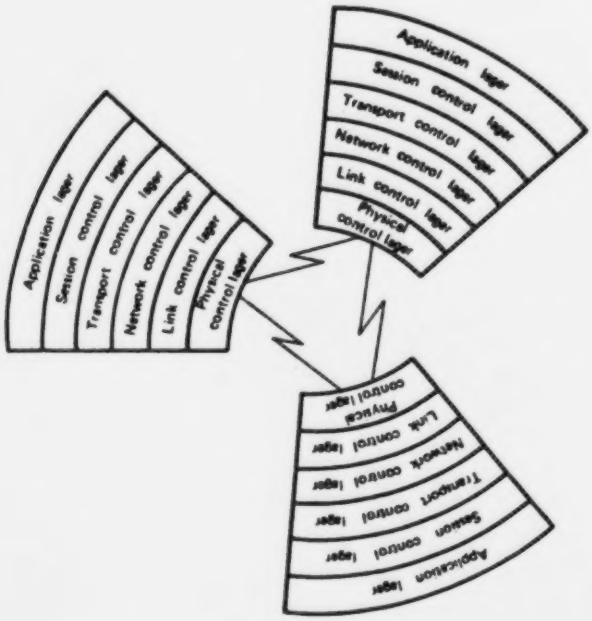

Fig. 2. Hardware/software architecture of the VNS
[The word "lager" should read "layer"]

Number of interrupt levels: 31 or 64, plus background.
A base-register addressing mechanism ensures the modularity of the programs running on the computer and provides program protection. The I/O system ensures the maximum overlap of the central-processor operations and the input/output operations, and thus provides high-speed system operation.

There is a real-time clock in the computer, which performs the time-handling operations , which are important in the divided system.

Above the level of the physical input/output handling, the VT60 is fully compatible with the ESER 1010/ESER 1012 computers, and, with its new commands (especially the bit-handling commands), offers the possibility of more effective organization of the programs.

Many peripheral devices, for example devices enabling remote handling and computer-to-computer connection, can be connected to the VT60. All these factors make the VT60 particularly useful for handling real-time tasks or for use as front-end processors for no less divided large computer systems. They also make it useful as a communications handler or as an intelligent terminal.

In the VNS network, the VT60 performs the role of communications handler, but theoretically it could also serve as resource computer.

Standard Monitors

Videoton offers a wide range of software -- operating systems, data-set handling systems, standard processors -- for the VT60 computer. There are three types of operating system:

- Disk Basic Monitor (DBM);
- Real-Time Disk Monitor (RTDM); and
- Multitask Monitor (MTM).

The DBM, as its name already indicates, supports the batch operating mode; basically, it is recommended for program-development and data-processing jobs.

The RTDM monitor is a memory-resident operating system, which permits real-time multiprogramming and time handling. There is no need for a system disk for the user system resident in the memory operating under the RTDM monitor.

The MTM is a fixed-partition multiprogramming operating system, which offers means for the transfer of the momentarily not activatable user tasks to the system disk (swapping) and thus for major "virtual" increase of the actual physical central memory. This operating system necessitates a system disk.

The operating systems listed above contain no data-set handling system. There are three different data-set handling system available in the VT60 computer:

- Direct;
- Sequential; and
- Index-sequential.

In the DBMF, RTDMF, and MTMF operating systems there are means for using the direct and sequential data-set handling mode.

The DBMI, RTDMI, and MTMI operating systems are additionally also capable of handling index-sequential data sets.

The DMS60 data-base handling system enables the handling, the interrogation, and updating of the data bases.

Reasons for Creating PROCESS-2000

The wide range of uses to which the Videoton standard monitors can be put is demonstrated by many systems. It is not surprising that there would be people who question the need for the development of an additional operating system.

The VNS packet-switched network imposes entirely new demands on the operating system, partly because the functions, which differ fundamentally from those of conventional systems, and partly because of the configuration of the layer-layer (more accurately process-process) system, which meets the international standards.

Let us review the reasons which excluded the application of the individual standard operating systems.

The configuration of the nodal-point computers of the VNS contain no magnetic disk unit for reasons of economy. This excludes the possibility of using the MTM and the data-set handling monitors. It should be noted that there is actually no need for the latter since the data sets required for the nodal-point operations are not required; their handling would have considerably slowed down the system.

The nodal-point software consists of parallel (pseudoparallel) operating processes, of which the task is to handle the stochastically occurring events. This requires a high degree of multiprogramming, and this already excludes the use of the DBM monitor.

This leaves the RDTM, but not for very long. As we have already mentioned, the VNS (and the NSS within it) is a software system of layered configuration, following the concept of the Open System Architecture.

Information exchange among the layers and within the units of layers takes place by transmission and reception of message packets. This mode coordinates the processes too in the present version, although this was not always the most economical approach.

Conditions for the transmission and reception of messages are mailbox type handling, dynamic buffer handling, and sequential handling at the level of the operating system.

The RTDM lacks these functions; however, it has numerous operations which are entirely unnecessary for the application involved. It was therefore necessary to incorporate the lacking operations and to free the memory space occupied by the codes of the superfluous features. We started out from an RTDM operating system and gradually added the new sections, and adapted the remaining functions (data entry and removal, time handling) to the new system concept. Finally, we eliminated the unnecessary monitoring program sections from the system. This is how the PROCESS-2000 operating system evolved.

Part II of the article will contain the description of the architecture of the operating system and some details of interest concerning its realization.

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CSO: 2502

CENTRAL COMPUTER DEVELOPMENT PROGRAM FOR SIXTH FIVE YEAR PLAN

Budapest SZAMITASTECHNIKA in Hungarian Dec 81 pp 2, 3

[Article by Dr Lajos Varga: "The Central Computer Development Program in the Sixth Five-Year Plan Period"]

> [Text] In April of this year the Council of Ministers passed a resolution concerning the tasks and pace of the Central Computer Development Program (SZKFP) in the Sixth Five-Year Plan period. We reported on the chief characteristics of the program in our May issue. The resolution of the Council of Ministers prescribed that a report should be prepared for the State Plan Committee (ATB) concerning the tasks of carrying out the SZKFP, taking into consideration the 5-year plans of the managing organizations (enterprises and cooperatives), the preparation of which was due in June of this year. The ATB discussed and accepted this report at the beginning of November. (In this article we will deal with questions of applications; we will write in a later issue about plans and tasks of domestic computer technology manufacture.)

The chief requirements made of the program, in harmony with what is contained in the Sixth Five-Year Plan of the People's Economy, are the following.

The emphasis of the program should be applications of computer technology and the level of computer technology services should improve. In regard to the devices used the ratio of domestic and socialist import computers should increase. Use of the tools should expand primarily in areas directly supporting economic policy goals, especially in the areas of enterprise management and production guidance and the automation of technological processes.

The harmonization of systems must be increased in state administrative computer technology applications, keeping in mind efficiency requirements in a far-reaching way.

Research and development, manufacturing and specialist training should develop in harmony with domestic needs and international obligations.

The concrete program of the SZKFP contains a series of coordinated tasks and measures--designating those responsible and time limits--with the execution of which the above outlined chief requirements made of the program can be realized. Thus:

--building computer technology into social and economic processes will continue in a coordinated way,

--the level of computer technology applications will increase,

--the efficiency of the use of the available technical and intellectual resources will increase, and

--participation at every level of execution will be more active and more purposeful than earlier.

On the basis of the achievements of the SZKFP thus far computer technology applications extend potentially to every area of social and economic life; thus every organization of the economy is affected by it, although their interest necessarily differs in regard to the degree of use and changes with time. It has been proven that the efficient use of computer technology is a very important, recognized tool for the intensive development of the economy and an unfolding of innovative processes. It aids the planning of economic processes, the flexible guidance of them adjusting to internal and external conditions, the taking into account of results and an evaluation of developmental trends.

The program includes a number of measures for developing applications and raising their level. The most important tasks in state administration are:

--the development of cooperation among central information systems--planning, financial, statistical and labor affairs,

--the development of administrative and guidance information systems for economic ministries and organs with national authority,

--the development and rational coordination of basic national records--population records, real estate records, regulations and highway vehicle records--taking into consideration the possibilities of a regional division of labor, and

--the modernization of council administrative information systems with increased use of the possibilities of computer technology.

These information systems occupy an eminent position among state administrative applications and the program will turn the resources available primarily to a coordinated development of these systems. An important task awaits the information supplying organizations of the OT [National Plan Office], the KSH [Central Statistics Office], the PM [Ministry of Finance] and the ABMH [expansion unknown] which, supported by the State Administrative Informatics Development Society, must see, during the plan period, to the substantive and logical harmonization of the data bases of the affected organizations and then

create, by the end of the plan period, a coordinated national economic computer data base system. An important element in the activity of the society will be the development of broader cooperation in the interest of more efficient use of certain data bases of other information systems, of outstanding importance from the viewpoint of the national economy, avoiding the creation of superfluous capacity, primarily cooperation with the information supplying organizations of the MNB [Hungarian National Bank], the OAAH [National Material and Price Office], the KKM [Ministry of Foreign Trade] and the Ministry of Industry.

Another stressed area for developments financed from the budget is the computerization of education. This is illustrated by the fact that the share of education is about one quarter of the available budgetary investment resources. Gradually making the teaching of computer technology applications general even in secondary education is indispensable for raising the general level of application information, laying a foundation for the computer technology information of later potential users and realizing our long range economic development policy. The program considers it possible to lay the foundations for this by making available micro-and minicomputers.

In regard to the capacity needed for higher education one should think not only of new investments and reconstruction but also of the organized inclusion of the resources of computer technology systems operating in state administration and certain service organizations. In creating the conditions the program counts on the creative initiative and cooperation of organizations having appropriate tools and possibilities. An important role will also fall to study courses offering general applications information to leaders.

The application of computer technology will have an unambiguously important role, though to a differing degree, in the sixth 5-year plans of management organizations--in the interest of achieving the national economic goals. An aspiration has been formulated in the plans to gradually integrate computerized solutions for management and guidance, technical design automation and technological process control into a common system. Some of the applications plans will aid directly the execution of developmental programs approved in the national economic plan also. For example, the OKGT [National Oil and Gas Industry Trust], the coal mines and the MVMT [Hungarian Electric Works Trust] will support the energy management program; the MAT [Hungarian Electric Works Trust] will support the aluminum industry program; the pharmaceutical industry and chemical industry enterprises will support the pharmaceuticals, crop protection materials and intermediaries program; and the significant development of chemical industry enterprises coordinated by the Chemical Industry Computer Technology Development Association will support the petrochemical program. Two large enterprises of domestic computer technology manufacture, Videoton and the Telephone Factory, also have computer technology applications plans embracing their guidance and management systems.

Important computer technology tasks have been forumlated in the transportation and communications branch, the execution of which will contribute to the efficient use of significant economic resources in rail and highway transportation the MAV [Hungarian State Railways] and VOLAN. Among the

applications intended to improve the management of the Hungarian Posts the computerization of the check accounting system serving to accelerate financial transactions is of outstanding significance.

Substantial developments are represented by the computer technology plans of those large industrial enterprises which will have the conditions for swifter economic development or which carry out significant production and export tasks (for example, Ikarus, Taurus, the Paper Industry Enterprise, the Danube Iron Works and the Alba Regia Construction Industry Enterprise) and of a few organizations of agriculture and the food industry.

The role of stockpiling enterprises is increasing in keeping track on a daily basis of the location of the most important economic stockpiles and of the flow of materials. In the interest of increasing the operational nature of this information four significant TEK [Capital Equipment Marketing] enterprises (AUTOKER [the Auto and Spare Parts Trade Enterprise], FERROGLOBUS, VEGYTEK and ELEKTROMODUL) are planning the use of modern data processing and business systems which will constitute the basis for a national economic stockpiles information system.

The development of the computer technology systems of financial institutions--the systems of the OTP [National Saving Bank] and the AB [State Insurance Enterprise] (deposit accounts, check writing by the populace, vehicle insurance and paying for damages)--and of the AFIT [Industrial Trust for Auto Maintenance] will contribute directly to raising the level of services to the populace. Rational management of hotel and other lodgings is a significant factor in the development of our tourism.

The goals and the tasks to be solved are differentiated to a great degree in the several user organizations. About 30 significant computer technology development projects linked to national economic goals have been developed and these are supported by detailed plans. About 250 management organizations (enterprises, trusts, trust enterprises, member enterprises of associations, state farms, etc.) are directly affected by the realization of these projects.

In these projects they plan the creation of integrated guidance and management information systems, devoting a stressed role to operational production guidance. Almost every plan is based on making use of remote processing, thus increasing the operational character required by adaptation to the environment and aiding the availability of the information needed to guide multiple-site large enterprises and farms in accordance with the needs of production, stockpiling and transportation. About one third of the plans count to a significant degree on bringing in institutions providing computer technology services. Central and branch research and development programs will aid the realization of some developments also.

In harmony with the national economic planning system the program does not regard as closed the sphere of organizations realizing the above mentioned projects. It assumes that in the course of executing the plan the possibilities and goals may change at some organizations. Thus our computer technology developments will be modified or diverted from them while at other organizations computer technology may be given an emphatically important role in the course of the plan period.

Creating receptivity at the user organizations is a basic condition for efficient use of computer technology. The program will continue to turn great care to watching and influencing this, weighing the possibilities of the national economy. We are talking about receptivity in a double sense. On the one hand it means a correct judgment or evaluation of the ability of the organization to accept a system. This must be solved primarily by the supreme leadership of the organization. On the other hand it means ensuring the conditions to accept a concrete computer technology system, which is more the task of the technical leadership. The activity of institutions providing computer technology services is crucial in creating receptivity.

The development of the system of institutions providing computer technology services is of crucial importance in carrying out the tasks of the organizations using computer technology. They provide intellectual and machine capacity for the organizations turning to them; by the second half of the Sixth Five Year Plan it is expected that this will be done via remote data processing links also. They take part in systems development and cooperate in their introduction and in preparing the organizations. The organizations offering an applications development service occupy a leading place among those providing services. As of 1 January 1982 the KSH will have created the Computer Technology Applications Enterprises (SZAMALK) on the intellectual and machine base of the SZAMOK [Computer Technology Training Center], SZAMKI [Computer Technology Research Institute] and OSZV [National Computer Technology Enterprise] institutions, to carry out national level tasks. To a crucial degree the activities of the new institution will be made up of services connected with the preparation of applications, the creation and maintenance of ESZR/MSZR [Uniform Computer Technology System and Minicomputer System] systems and providing software.

Videoton will gradually build up a national network to provide customer services and associated device-oriented applications development services for its products.

In the execution of the program the program counts on "small" service organizations adapting to environmental expectations in the areas of consulting, software supply and maintenance and organization.

In the interest of rational use of capacity the program wants to aid the creation of associations with the participation of budgetary organs and enterprises, on the basis of the favorable experiences thus far.

The basic expectation in regard to organizations providing computer technology services is that there will be a breakthrough and that the creation of ad hoc systems will gradually be replaced by the creation of intellectual products which can be generally used and propagated. The program judges that the conditions for this are largely given in the system of professional institutions. In order for computer technology investments to represent a real alternative to other investments, to an increased degree, the program sets forth a conditions system harmonized with the economic possibilities.

Machines of domestic manufacture and socialist import ESZR/MSZR machines will make up by far the greatest part of the hardware investments. The commercial and trading enterprises will have the task, while paying attention to trade policy viewpoints, of acquiring devices which ensure modern operational modes, have a reliable and continual supply of parts and a supply of software. In the interest of increasing the reliability of these systems and in order to solve some economically significant tasks it will continue to be possible to count on non-ruble accounting import also, as a function of the current general economic situation and ability to deliver.

In order to realize the goals of organizations using computer technology and in order to make effective use of the devices the program regards improving the level of software supply to be a stressed task. It plans to solve this task in harmony with research and development and applications development.

In the interest of providing basic and systems software for imported ESZR computers the development of framework software systems has begun already. This store of programs will be expanded in the course of the plan period. Software purchases to satisfy national level, general needs will take place within the framework of and to the burden of the Computer Technology Applications Development Fund. It is expected that a remote data processing monitor will be acquired in the near future, with the aid of which the earlier acquired and already widely used IDMS data base management system can be operated in a remote data processing environment. We are in the process of acquiring a program package suitable for efficient, grouped data collection tasks on MSZR machines and a data base management system based on these machines which will aid more efficient utilization. We mention here only equipment which will be realized in the near future. In the area of improving software supply the possibilities of socialist international contacts have not yet been exploited sufficiently. The acquisition of good systems suitable for use nationwide could be prepared with a more flexible business and market policy.

Within the framework of program A/6, dealing with research and development on computer technology applications systems, of the National Medium Range Research and Development Plan (OKKFT) and in harmony with measures of the SZKFP we have planned, among other things, the creation of a services laboratory based on existing equipment which will aid a broad range of applications with economical, good quality program products and demonstrate in practice the possibilities of producing economical software in an industrial way. As a new type of service we will make hardware and software available to the development experts of users.

The increasingly significant non-ruble accounting export of software is a unique area for acquiring and passing on information. In addition to generating foreign exchange directly it makes possible the adoption of modern, developed technologies in that the participating institutions are filling orders which have higher quality requirements than the domestic ones.

Obtaining the financial resources for the computer technology hardware investments planned by the management organizations is not free of problems. It is an important condition for the realization of their developmental goals

that credit resources of suitable magnitude be available. The currently valid credit policy guiding principles are a condition for making use of credit. Taking into consideration the narrowness of resources available at the national economic level it will be necessary to conduct a selective credit practice. The primary viewpoint in judging credit competitions--as for other investments--should be the utility and efficiency of the system. In harmony with the economic policy goals of the Sixth Five Year Plan the program counts to a more significant degree than earlier on the management organizations making use of their own resources. In this connection also a computer technology investment is "only" an investment. So it should fit the chief goals of the organization and represent a realistic resource alternative for attaining them.

The program will pay close attention to the availibility of credit resources at all times and as necessary will devise measures to solve problems which arise. In the interest of this, however, it will be necessary for the management organizations to have definite medium-range computer technology ideas, in harmony with their medium-range plans.

The SZKFP occupies a special place among central developmental programs. It has a complex linkage system with other stressed government economic programs and it can effectively support their fulfillment. More than 50 percent of the management organs are affected in its execution. Guidance of the program is based on the coordinated activity of a number of chief authorities and it will adapt flexibly to changed economic conditions. It will be continually harmonized with goals defined in the national economic plan and with the pace of their execution. The several components of the conditions system will be coordinated, with special regard to software supply and raising the level of applications development services.

The measures of the concrete program of the SZKFP--formulated on the basis of observations from a broad circle of those interested--provide the necessary frameworks for further progress. But attaining the goals put forward will require the coordinated work of the organizations already using computer technology and those planning to exploit the possibilities thereof.

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BULGARIAN SPECIAL MICROPROCESSOR SYSTEMS

Budapest SZAMITASTECHNIKA in Hungarian Dec 81 p 4

[Article by "sk": "Bulgarian Special Microprocessor Systems"]

[Text] In the applications systems described in the article the specifics of the tasks dictated that goal-orientated microprocessor control units (microcomputers) be developed. Task-oriented peripheral equipment is connected to these also.

The IZOT 1001 C Entry and Exit Control System

The IZOT 1001 C system serves to check the presence and movement of employees in factories and institutions. The system makes possible the introduction of flexible work times, which is advantageous in production, and helps to solve transportation difficulties or problems (for example, if a worker must leave the job prior to the end of work time on personal business).

At the end of the accounting period (week or month) the system prepares a report on the time worked by every single worker and this report can be used for wage calculations.

There are various ways to check presence and movement during work time, which can be automatic or non-automatic. From this viewpoint the IZOT 1001 C system is among the most modern automated systems.

The chief functions of the system are the following:

--with the aid of terminals placed at entry and exit points it checks the entry and departure of personnel with the aid of personal magnetic identity cards;

--it prepares a printed certificate on every entry and exit;

--it records the information on a flexible magnetic disc;

--it stores data on every person separately;

--on command by the operator it displays or writes out the data pertaining to individuals;

--it checks the correctness of the personal magnetic identity cards; and

--the parameters of flexible work time can be set in accordance with the needs of the several user institutions.

The system can serve institutions with a maximum of 3,000 people. It stores the data pertaining to each member and at the end of the accounting period it displays these data on a printer, also recording them on flexible magnetic disc for further processing.

The entry and exit terminals are intelligent equipment controlled by a microprocessor. These are placed at entryways and exits. The terminals have a magnetic card reader, a special functional keyboard and digital display. When the personal magnetic identity cards are placed in the reader the flexible work time balance at the time of entry or exit appears on the display. It is possible to indicate with the functional keyboard whether an entry or exit is taking place, among other things.

In the configuration of the system there are, in addition to the central unit, a screen display with alphanumeric keyboard, an ESZ 7184 daisy wheel printer, a flexible magnetic disc unit, and IZOT 6500 C magnetic card accounting device and, in the present version, three IZOT 6600 C entry and exit terminals.

Typing and Text Processing System

The typing and text processing system serves to automate typing and greatly increases the efficiency of work connected with preparing, editing and duplicating texts. The core of the system is the IZOT 1002 C text processing system, which offers a number of advantages as compared to traditional methods.

The system, which automates typing and text processing, offers the following aid in connection with processing textual documents:

--initial typing of texts;

--editing and correcting of texts, in the course of which signs or letters can be inserted, transposed, shifted or erased and words or entire portions of text can be moved;

--printing out of texts, in the course of which one can prepare a working copy or a typewriter quality printout containing the final text of the document;

--duplication of documents;

--recording of finished documents or documents being worked on on a magnetic data carrier, cataloging and classifying them, thus providing for automatic retrieval of the stored information; and

--addressing letters according to the address list provided.

When developing the configuration of the system far-reaching attention was given to the requirements of modern work organization and technological processes of

typing offices. The separate operator consoles were developed taking into consideration ergonomic conditions which make possible work over long periods.

The central unit of the IZOT 1002 C text processing equipment constituting the core of the system is based on a microprocessor in the 600 family, with 48 K bytes of operational storage. This is connected to a Latin and Cyrilic alphanumeric and functional keyboard, an ESZ 7187 daisy wheel printer with a writing speed of 30 characters per second, a VKP 291-2 display (displaying 80 characters in 24 lines) and a flexible magnetic disc memory.

Documents are typed by a MARICA-11 and MARCIA-12 electric typewriter with 44 keys and a roller width of 235-245 mm.

An OT 2003 and an OT 2008 light copier provide copies of documents. The OT 2003 makes eight copies a minute in the A4 format (without reduction), with automatic paper feed. The speed of the OT 2008 is 50-150 copies per minute, with a document size of 250 X 351 mm. Paper feed is automatic or manual.

The system includes various types of office equipment--desks, files, storage for flexible magnetic discs, telephones, adjustable desk lamps and typists' chairs.

The IZOT 1003 C

The IZOT 1003 C microcomputer system was designed to automate information processing for department stores and commercial centers. With its aid one can provide better information for various leadership levels, automate administrative functions and improve the efficiency of the entire institution.

A special, high level language was developed to prepare user programs. The translating system of the language, which is made available to the user on disc, makes possible the quick and easy writing, translation, testing, correction and recording on flexible magnetic disc of programs. In addition the system provides for the copying of programs, records or texts from one disc to another, the copying of the entire contents of a disc, the preparation of discs for writing (zoning), the running of diagnostic tests and the transmission-reception of data on telecommunications lines.

The IZOT 1003 C system makes possible the automation of the following types of administrative operations:

--keeping track of the arrival and shipment of goods by quantity and value;

--recording price changes and carrying them over to a given period;

--keeping track of the fulfillment of contracts and orders;

--keeping track of fulfillment by period, type of product and product groups; and

--wage accounting.

The equipment consists of one operator console and two separate units. In addition to a microprocessor control unit belonging to the SZM 600 family the operator console contains:

--a keyboard (for the input of alphanumeric data, programs and texts), separate numerics for the input of numbers and a functional keyboard to give operating modes or query conditions;

--displays: a numeric one to display input numbers and intermediate results and a functional one to display the state of the system; and

--an ESZ 7187 printer with a speed of 30 characters per second, equipped with special electromechanical feed equipment.

The central unit uses 24 K bytes of operational storage and 18 K bytes of ROM. The operations which can be done with 14 digit numbers are: addition, subtraction, multiplication, division and calculation of percents and miles. The text register is 128 characters long.

One of the separate units contains two flexible magnetic discs and the other contains one flexible magnetic disc and a modem. The system can store 30,000 records on one disc.

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MERA 9150 GROUPED DATA RECORDING EQUIPMENT

Budapest SZAMITASTECHNIKA in Hungarian Dec 81 p 4

[Article by S.Z.: "The MERA 9150; A Modern Device for Data Preparation"]

[Text] For a long time data recording has been the bottleneck for data processing. The development of devices and of computer technology has brought the times needed for the two mechanical functions--data input and the display of results--close to the processing times. The display of data is solved with the development of buffering technology; data recording is solved with the development of grouped data recording and data preparation equipment.

Grouped Data Recording

We could first meet with grouped data recording equipment 10-15 years ago. Since then development has been in three directions.

1. The appearance of complex data preparation functions with data recording--checking, editing, actualizing, ordering, conversion and data protection.

2. The appearance of special peripherals (in addition to punch card and punch tape readers)--picture tube terminals, optical character readers, industrial data collection stations, sound sensing terminals, matrix printers and line printers.

3. The effect of the development of remote data processing--distant data recording stations and systems thereof, remote programmable intelligent terminals, and grouped data recorders connected directly to a large central computer system.

With the spread of these trends the applications sphere of grouped data recorders broadened and they are indispensable in modern, efficient data processing.

One can find in our homeland quite a number of types of grouped data recorders. In recent years there has been a socialist supply also. In addition to the Hungarian made VIDEOPLEX types the Polish MERAMAT firm is manufacturing, on the basis of a Redifon license, the MERA 9150 grouped data recording equipment.

The first arrived in our homeland last year; at present 10-15 are in operation. In the future also the Polish side will be able to satisfy the demand.

The MERA 9150 And Its Possibilities

The equipment provides for input of data from the keyboards of stations with picture screens and the collection of them on magnetic disc (key-to-disc system); in addition it provides for the recording on magnetic tape from magnetic disc of checked and ordered data, which can be an efficient input for processing on a large computer. General operation of the system is ensured by the 7.E operating system provided by the manufacturer. The tasks which can be performed can be grouped around data recording and complex data preparation activities.

Data recording on the MERA 9150 system takes place on a picture screen unit with a modern alphanumeric keyboard. Textual error messages and technical information aid the work of the data recorder. Dynamic erasing and insertion of characters, fields and records is provided. Within one batch the operator can check any preceding or following record. One can query key field or character line. A flashing cursor indicates the character line found on the screen. Simultaneous multicopy printing can be performed with the data input operations.

The following activities are possible with complex data preparation:

--checking: the data can be checked syntactically (depending on recording) and semantically (reflecting content relationships). To increase the precision of data input one can generate and evaluate check digits. Checking can be at record level or batch level. In addition to indicating faulty fields and records one can prepare a list of faulty files.

--ordering: with the aid of prepared ordering programs the records of any batch can be put in order according to a key developed from one or more fields.

--conversion: the system works with an EBCDIC code set but with the aid of system programs one can set up ASCII, BCD, Honeywell, ICL and other special code sets.

--actualization: data already recorded and stored on magnetic disc can be modified.

--data protection: activities of the control operator (supervisor mode) are protected with a password in the interest of avoiding unauthorized access.

In the MERA 9150 system there is no need for a favored work station to perform supervisory functions. Any station can be made into the control station by means of the supervisory key. From a work station one can perform recording, checking and correction; other activities are in the supervisor mode.

The system can be programmed in the VALIDATOR high level problem-oriented language. The language is of the COBOL type and can be learned easily.

One can prepare the following programs in the VALIDATOR language: a record checking program, a batch checking program, an ordering program and an output editing program.

The MERA 9150 hardware can be built modularly. The central unit has a universally programmed processor and ferrite operating memory with a capacity of 32 K words (one word equals 16 bits).

The cycle time is 1,200 ns. The magnetic disc storage (MERA 9425) is manufactured on the basis of a CDC license and has a capacity of 5 M bytes. (Of this 2.5 M bytes is fixed and 2.5 M bytes is exchangeable). A maximum of two units can be connected to the magnetic disc control unit. The magnetic tape storage (PT-305) has nine channels with a writing density of 800 bpi. The equipment meets ISO standards. A maximum of four units can be connected to the magnetic tape control unit. The average printing speed of the DZM-180 matrix printer is 45-55 lines per minute; it has a character set of 64 and the maximum number of copies is five. The data input station consists of a screen and a keyboard. Two types of keyboard are possible: a punch card type and a typewriter type (and control keys). The maximum number of data input stations in one system is 32 (the recommended maximum is 24). With a line amplifier the maximum distance of data input stations from the central unit is 610 meters, without it the maximum is 350 meters.

The MERA 9150 can also be operated in a remote processing network, with an IBM 2780 terminal algorithm.

Equipment being developed is: a card punch, a line printer, an optical character reader, a remote terminal, an interactive remote terminal and an intelligent terminal.

Direct connection of the system to a large central computer is being developed. The space requirement for the central unit of the MERA 9150 configuration is 15 square meters. Its price with eight work stations is 5 million forints and about 6 million forints with 16 work stations.

Technological Advantages

--Easy to operate, picture screen input, a flashing cursor and information aiding the work of the operator (a help subsystem);

--Divided data input, a 32 terminal maximum, as much as 610 meters from the central unit;

--Automatability (a program library and system programs for typical tasks);

--Reviewable, multicopy, edited output;

--Reliability and data protection; checking routines, algorithms, password protection;

--Operation; it is possible to increase efficiency via evaluation of operator's statistics and selecting the optimal ratios of operational modes.

On the basis of the favorable technological properties and the acceptable price/performance relationship we expect the spread of the MERA grouped data preparation equipment, which is available from the socialist relationship along with the Hungarian VIDEOPLEX equipment. The OSZV [National Computer Technology Enterprise] will market the MERA system and provide complex technical services.

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INTERVIEW WITH V. A. MYASNYKOV

Budapest SZAMITASTECHNIKA in Hungarian Dec 81 p 9

[Interview with V. A. Myasnykov, computer technology chief of the Scientific and Technical State Committee of the Soviet Union, by K. S.: "New Architectures; Software Will Be a Commodity"]

[Text] On the occasion of the second international conference on "Use of Microprocessors and Microcomputers," held in our homeland at the beginning of October, V. A. Myasnykov, chief of the Computer Technology and Automated Control Main Directorate of the Scientific and Technical State Committee of the Soviet Union, visited Hungary and gave a talk at the conference. He visited a number of technical institutes. The chief director gave the following interview to our journal.

[Question] At the present time, obviously, the greatest attention is being turned to applications of computer technology in the Soviet Union, just as in our homeland. Could you outline the most important trends in this area.

[Answer] In the Soviet Union great attention is being turned to perfecting economic guidance, to increasing the efficiency of social production. A primary role is being given to applications of computer technology and automated and automatic guidance systems. At present we attribute the greatest importance to the following computer technology applications systems.

The first group of systems is automated and automatic guidance systems for complex technological processes, equipment and special systems. Here we regard automatic systems as the limiting case of automated systems, where a human either does not participate in or merely watches the control process. There are now nearly 3,000 such systems in the Soviet Union. The second group of systems is automated economic and organizational guidance systems (branch automated guidance systems and automated guidance systems of associations and enterprises). Virtually all republic and all-union ministries carry out their tasks with the aid of branch computerized guidance systems. At present these number 270; there are 2,500 enterprise guidance systems. Automated technical planning systems (AMT) belong to the third group of systems. The fourth group consists of automated systems for scientific research and experiments. As a fifth group I would mention information retrieval systems.

[Question] According to our information the role of the Scientific and Technical State Committee of the Soviet Union (hereinafter, GKNT) in the development of Soviet computer technology resembles that of the SZKCP [Central Program for Computer Technology] committee here. Could you tell us about the activity of the Computer Technology and Automated Control Main Directorate.

[Answer] Work in the lines listed above takes place on the basis of complex programs which are organized by the GKNT. The organizer of the complex programs within the GKNT is the Main Directorate for Computer Technology and Control Systems.

It is obvious that the creation of new systems and the further development of existing ones is impossible without the appropriate technical and programming tools. Therefore the main directorate, together with the appropriate ministries, has developed a few programs which are directed directly at the development of computer technology tools. Hungarian experts are well acquainted with the Soviet computers of the ESZR [Uniform Computer Technology System] and MSZR [Minicomputer System] types manufactured in series and with those the development of which will be completed in the 1981-1985 period. So I would like only to emphasize that the essence of our developmental strategy is to accelerate the creation of universal, very high performance computers (5 million operations per second and above) and to greatly increase the number of mini-and microcomputers available. This is dictated primarily by the requirement of planning and putting into operation more actively than heretofore collective use computer centers where the mini-and microcomputers function as intelligent terminals. Thus the specific quantity of medium capacity computers will decrease in comparison to the total computer park. I should also note that the collective use computer centers must provide users not only machine time but also programming services. In order that industry should develop and manufacture those technical and programming tools which are most important for the economy of the Soviet Union we have introduced a system according to which the technical plans for the development of computers, general purpose peripheral equipment, mini-and microcomputers and software for all these must be harmonized with the Main Directorate for Computer Technology and Automated Systems. In addition, the enterprises manufacturing computer technology devices must harmonize manufacturing specifications with us when starting manufacture. Thus not only can we maintain control of the technical level of computer technology equipment but also we can integrate those needs, the "orders," which all branches of the economy make in regard to the technical and programming tools needed in the country. This shows the great advantage of a socialist planned economy.

[Question] In what directions is computer technology development going most intensively?

[Answer] It is our opinion that developmental work in the area of computer technology must be made more intensive in our homeland, we must work out possibilities for the realization of new architectural solutions which, even in their basic principles, go beyond the traditionally developed computers.

In the Soviet Union, for example, successful developmental work is being done in an institute belonging to the Ministry of the Instruments Industry, Automatic Devices and Control Systems, dealing with control problems, directed at the creation of a computer with a restructurable architecture. Series manufacture has begun already; in the area of the Higher and Middle Education Ministry of the Russian Federal Republic the development of so-called recursive computers is proceeding very successfully. We are turning the greatest attention now to microelectronics, the development of which is having a revolutionary effect on the development of computer technology and on its penetration of every area of life. In the Soviet Union they are now working on a complex program directed at broad application of microprocessor computer technology; they will devise microprocessor type tools for the control of various types of equipment, instruments and measuring devices. The training and tetraining of experts in higher and middle study institutions will play a very great role in this important question.

[Question] You have now visited Hungary for the first time. Give us a few words about you impressions and experiences.

[Answer] Getting to know the Hungarian institutes playing a leading role in the area of computer technology development, among then the Videoton Electrotechnical Factory, and my conversations with the leadership of the OMFB [National Technical Development Committee] and my colleagues working in the Computer Technology and Automation Secretariat have convinced me that in Hungary also great significane is attributed to the use of microprocessor devices. It is worthy of note than an international conference dealing with the use of microprocessor devices has been held in Hungary for a second time. The Soviet delegation, and myself personally, was very pleased by the well organized conduct of this international forum and by the information provided by the very substantive presentations.

As for my impressions gained on the basis of my visits to the institutes and my conversations about computer technology with Hungarian experts, I might formulate these as follows. Very good quality characterizes the development and production of computer technology devices in Hungary; I find the development of software especially intensive. Extraordinarily great demand is appearing in the Soviet Union for systems operating on the basis of the ESZ 1010 machines and for the peripheral equipment, especially the terminals.

[Question] You stressed the intensity of Hungarian software development. Unfortunately we cannot yet boast of any great success in software trade among socialist countries.

[Answer] That is true; but as long as we are talking about software, I would like to speak about it a little more broadly. We have come to the important recognition that software products must be treated in exactly the same way as other products of basic production, a decision which has economic, legal and other consequences. Now the situation, even for us, is that the value of program tools. Simply recognizing this fact makes it possible to develop prices for software products correctly and we should improve trade in software with a buying and selling machanism.

Permit me one more observation. Academician Glushkov has said that the principle of highest level leadership is extraordinarily important for any automated guidance system. If the leader--at whatever level of leadership--does not maintain control over the perfection of the guidance system, and thus the economic system, aided by computer technology then such as system will be of very little use. So the further training of those working in leading positions is very important in the area of the applications possibilities of computer technology and economic-mathematical methods. We have done very much for this in the Soviet Union already. The Economic Guidance Academy has been working with the Council of Ministers of the Soviet Union for several years--institutes providing further training for leaders work successfully in every branch.

The chairman of the GKNT, Academician Marchuk, a famous mathematician, initiated and personally led a series of study courses on computers and their applications for leading workers of the GKNT. This was a natural step, for the committee is the leader of scientific and technical progress--and computers and the systems based on them are influencing every area of our activity.

Finally, I would like to express my appreciation to all my Hungarian colleagues, who devoted great attention to the stay here of the Soviet delegation.

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DATA-BASE HANDLING SYSTEMS IN VIDEOTON COMPUTERS

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UNGAR, JANOS, program designer, Videoton Development Institute

[Abstract] The DMS60 and DMS600 systems, designed for the ESER 1010 and ESER 1010M computers, respectively, are described. The DMS600 is an upgraded version of the DMS 60, the former containing additional quantitative features and auxiliary programs. The upgrading is part of the development concept following the sequence from ESER 1010 through the ESER 1010M to the ESER 1011 (progress from multitask operation to multiprogramming operation) and the sequence from the MTM monitor to the MTM2 monitor, as well as parallel upgrading of the corresponding software. Both systems are autonomous and can fully handle a broad range of tasks. They are CODASYL type multiuser systems, using network type data models. They maintain the data base up to date all time. They are on-line transaction systems in which the users are local display terminals. They also allow ad hoc interrogation at a high-level interrogating language. The systems have separate data-describing, transaction, and macro languages. The transaction language is used primarily to handle the terminals. The macro language is the means for base modification and ad hoc interrogation. Data protection and security provisions are available. The features of the data-base handling subsystem are the data structure, the memory structure, the structure of the internal data sets, the structure of the data-base record, and the programs of the data-base handling subsystem. The basic data-set handling operations are the interrogation of the data base, access to the record, reading the record into the memory, and modification of the data base. The person using the terminal uses the screen and the keyboard as if he were to fill out a form. The programs of the data-acquisition system are disk-handling and terminal-handling routines. There are also interface programs (to provide access to the data-base handling subsystem) and auxiliary programs (booting the data base, cold-hot restart, reorganization of the data base, data directory and data-path operations, updating of the data base, and handling the internal spool. Figures 7, table 1, references 5: all Hungarian.

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DEVELOPMENTS IN COMPUTER INDUSTRY DESCRIBED

Minicomputer Industry, Information Science

Warsaw INFORMATYKA in Polish No 11-12, Nov-Dec 82 pp 6-9

[Article by Doc Dr Eng Henryk Orlowski:* "The Minicomputer Industry and Information Science in Poland"]

[Text] Complying with a request by INFORMATYKA's readers on the present status of the computer industry and information science in Poland as well as the desired trends of development.

I would like to emphasize the difference between the computer industry and information science. The computer industry supplies the resources and working tools for information science, hardware as well as software. On the other hand, information science is that science and branch of industry that is concerned with computer applications and often with a change in environment in order to use computer techniques effectively (for example, a change in the method of management or organizational structures).

An analogous difference occurs, for example, between the industry concerned with producing automobiles and the engineering of road traffic. No matter in how many ways these two activities mesh with and affect one another, they use different methods in research and development work and in their economic practices require employees having different qualifications and, what is more important, the goals for their optimal operation can be different. I believe that many misunderstandings and even strains arising within groups in their formulations and activities can be avoided if the difference between the computer industry and information science is understood.

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* Henryk Orlowski finished his studies at the Department of Communications of Wroclaw Polytechnic in 1958. He worked for the CBKO [Central Machine Tool Design Office] in Pruszkow and at the Institute of Electrical Technology in Miedzylas on machine tool numerical control and, since 1962, on the use of the ELLIOTT 803 computer. During the 1966-1978 period, he worked on the application of computers in automation at the Industrial Instiute for Automation and Measurements. Since 1979 he has been a director of the Institute for Mathematical Machines and the chief designer of small digital computers in Poland.

The Present State of the Minicomputer Industry

In the mid-1970's, two negative factors appeared relative to the development and operation of the computer industry in Poland. First, the central authorities, deeply disillusioned with the results of implementing a number of large information science systems (information science was not the key to prosperity) and the known costs incurred for these systems (including foreign exchange), went to a second extreme. They recognized that the computerization of the national economy should no longer be supported (financially and otherwise). Secondly, they realized that the dynamic expansion of the investment program must be slowed down and that resources must be allocated for market production (to bring into balance payments made during the course of investing) and pro-export production (to repay debts). The economic strategy by no means encompasses all areas of investment, but it did affect information science and the computer industry. Computer equipment was considered to be capital goods production and domestic deliveries were severely curtailed.

In accordance with the ideology of this "strategy," only two actions were supported by the MPP [Ministry of Machine Engineering Industry]: market production and export. So-called co-production was tolerated but investment production was eliminated. In this situation the computer industry had the alternative of gearing up for export or cease to exist. The industry chose the former.

Among the three possible directions for export (utility systems, computer configurations and the bulk sales of peripheral equipment and memories), the minicomputer industry successfully realized the third. Production was systematically increased such that in 1980 about 19,000 units of memory and peripheral equipment were produced in Poland, of which 13,000 were exported. Exports to the dollar zone expanded so much that in 1980 more foreign exchange was earned than was paid out for the purchase of components and material from the II payments area [capitalist countries] for MERA's [Automation and Measuring Apparatus Industry Association] entire production. Exports to the I payments area are large and very profitable.

The success achieved here was due to license (especially for masaic printers and floppy disks), to our own developments (cassette tape memories, ferrite internal memories, reader stations and paper tape punches) and to post licensing developments (especially cathode ray tube monitors). The MERA-BLONIE plants became not only the largest printer factory in the CEMA but also in Europe.

In summary, in as much as the actions of the minicomputer industry in the production of peripheral devices and memories were very successful. Their achievements in the production of utility systems and minicomputer systems are significantly less so, less than our ambitions and potential capabilities. It is not, however, as some believe, an insignificant production. In 1980 about 800 microcomputer and minicomputer configurations were produced (from the largest to the smallest they are the MERA 400, SM 3, MERA 60, MERA 200, MERA 2500, MERA 100 and MERA 9150). Of this production, domestic customers

received only about 300 configurations, including about 170 of the well-known MERA 400's. The small number of domestic deliveries is certainly the reason why in fact the computer industry's production is not known.

Then what was the reason for the significant underproduction of microcomputers and minicomputers for export? The basic reason is the underdevelopment of our electronics industry. Considering the fantastic increase in the scale of integrating electronic components over the past several years, a computer industry that does not have access to modern components is destined to be underdeveloped (I would not like to prophesize that it would be eliminated).

To achieve the mentioned level of 800 configurations annually, various methods were contrived:

--To realize exports to the II payments area, the most modern components were purchased to assemble the minicomputers (MERA 2500, MERA 200 and in previous years the MERA 100). Because of their large foreign exchange costs, these minicomputers were not available on the domestic market.

--To realize exports to the I payments area [socialist countries] and to maintain sensible price ratios as well as to assure compatability with the SM [minicomputer system] family, processors were purchased from the Soviet Union on which the assembled systems were based, which were then exported along with the software (SM 3, MERA 60).

--Systems were produced for those domestic customers who could provide their own foreign exchange for the purchase of components (MERA 9150).

--The other export items (beside the unique ones) were utility systems that were sold in such large hardware and software configurations that the cost of the central processing unit ceased to be of importance vis-a-vis the entire configuration (for example, the MERA 400 to control a refinery in the USSR and the ODRA 1325 for the CRPD [Central Recording and Processing of Data] in Hungary). There also were sepcific orders, for example, from Italy for the purchase of a larger number of MERA 400 units, but the price the Italians were inclined to pay (and not surprisingly) for these configurations was less than half our production costs. This is but one more confirmation of the thesis that without access to components having a high degree of integration (including semiconductor memories) and at prices and of a quality to be competitive worldwide, it is impossible to produce profitable central processing units for microcomputers and minicomputers.

Another reason our exports of minicomputer configurations to the CEMA countries were limited was the fact that all of these countries initiated their own production of minicomputers and, in effect, for understandable reasons, did not want to purchase from us. If the mentioned reasons can be acknowledged to be objective (at least from the viewpoint of the computer industry) then a number of subjective reasons also appeared.

The computer industry assumed the burden of developing and producing the MERA 400 as a result of the termination of the infamous K-202 affair.

As a result:

--The finances and potential of the producers were split between two software lines (SM--to permit export and MERA 400--in order not to sell a completely naked replacement for the K-202).

--The software, training and technical literature associated with the purchase by Poland in the 1970's of several dozen PDP-11 configurations were not used in the development of the main minicomputer produced in Poland (that is, the MERA 400).

--The accomplishments of the domestic users of the minicomputer systems based on the MERA 400 were not profitable in export. CEMA purchasers were inclined to buy the SM line of minicomputer systems.

I believe this last result is especially unfavorable. It is a fact that the export of utility systems is much more profitable than the export of configurations, especially peripheral devices. Meanwhile minicomputer systems in Poland have been and are being developed mainly on the bais of the MERA 400. If, however, they were developed on the basis of SM hardware then we would have a wider range of offers to export to the I payments area (presently only CAMAC systems), and we also could export systems to the II payments area, replacing the original PDP-11 in the exported systems with SM central processing units and at the same time solving the problems of cost (which I mentioned above), unreliability, replacement parts and service of distant markets.

Another reason why our exports are limited has to do with the MERA 400 and MERA 200. In preparing the export of these minicomputers to the capitalist countries, MERA-BLONA, which did very well in the production of printers, did not take care ahead of time to offer extensive software at the same time it marketed the hardware. This mistake decreased the effectiveness of the offerings. Considering the features of the above minicomputers' basic software, a package of utility programs and systems for the end-to-end generation of programs were lacking.

In addition to the above mentioned reasons, a number of other factors, which have been characteristic for the entire economy during the entire course of its operation, are limiting the effective operation of the computer industry.

--The industry's entire production was based on the production of finished products, and the production of spare parts was severely limited. From another branch it is known that in 1981 over 40,000 tractors were not available for field work because of spare parts shortages. I do not know the numbers relative to minicomputer configurations and peripheral devices, but the tie-ups caused by a lack of spare parts are very large.

--Relics of 19th century economic doctrines that are burdening our economic life require that the software, design and service work done by the industry be treated as a surcharge on direct labor which places continuous limitations on them. A number of indexes obligating the industry (for example, the ratio of employees that are directly producing to those indirectly

producing plus research personnel) forced the industry, in the specific case of minicomputer configurations, to act against the best interests of the users, and thus the national economy as a whole.

--The imperfections of the trade mechanisms within the CEMA framework (which, in view of INFORMATYKA' thematic profile, I will not expand upon here) so far have made it impossible to benefit from all the potential advantages inherent in the uniform system of minicomputers in the CEMA countries (for example, independently configuring systems using equipment produced in different countries, software sales and the like).

--The necessity to carry out plans at all costs which gives rise to the production of systems configured according to production capabilities and not to user needs (this is the reason in general for the scanty operating memories) and to lowering quality below the design level and mastered manufacturing technologies. In association with this, the lower quality of products is caused primarily by:

--The shortage of production material (especially electronic components) which places limits on their aging and selection.

--The purchase of components abroad not on a continuous basis from the same suppliers but in a haphazard way depending on which countries the banks had foreign exchange surpluses or open lines of credit.

--Missing components often are received at the last moment and as a result systems are completed in haste, and in particular the aging and testing programs are not maintained. This is why some minicomupter configurations operate very well at the users' sites and others very poorly.

With what I have written above, I do not mean to imply that I am satisfied with the present status of Poland's minicomputer industry, and I suspect other reasons for eventual future imperfections lie in external factors. In any case, one can operate better or worse, and produce better or worse products. However, I believe that the present state of our minicomputer industry is much better than many computer scientists believe.

Prospects for the Minicomputer Industry

To maintain and expand the potential of the minicomputer industry, I believe that its pro-export character should be preserved. In this area, we should expand our production of peripheral equipment and auxiliary memories to be designated primarily for export to the CEMA countries. Considering investment limitations, I do not believe it is possible to expand equipment assortment, but we should improve the paramenters of presently produced equipment, increasing their production (including design and technological changes), eliminate the import of materials and components, and resolve problems as a composite unity (for example, we should initiate the production in Poland of disc files and disc cassettes in as much as we produce memories that use these devices). In due time we should also prepare new equipment in assortments produced to date.

To expand the production of peripheral devices and memories, especially minicomputer configurations, it is essential that Poland master the production of commercial electronic components of high and very high scales of integration. I beleive that in this area the close cooperation of the facilities of the electronic and computer industries is possible and downright necessary. In as much as the electronics industry already has the technology which would permit the manufacture of such components, then to a very limited degree it has the capability of designing and testing such components. The start-up time to initiate the production of new components is very long, and for economic reasons it will be impossible to produce small series of components, that is in such quantities that are needed by the computer industry.

The designing and testing of modern components can be done only by computer methods, thus it is only natural that the scientific research facilities of the computer industry would be instrumental in resolving these problems. Thus I believe that it is most important that these facilities participate in the preparations for the manufacture of modern electronic components, in addition to the development of peripheral devices and memories. Only when we have the capability of designing and obtaining components to satisfy our own needs will we really be able to develop and produce new central processing units and minicomputer configurations which would replace the generation of mini and microcomputers now produced in Poland.

From the viewpoint of the current needs of information science, in addition to equipping it with data carriers and other operating material, I believe that the industry would do the most good by upgrading existing configurations. This upgrading, among other things, should be based on:

--Rehauling all equipment having poor MTBF's (mean time between failures).

--Assuring proper servicing of replaceable packets or entire subassemblies, subsequently repairing them at the manufacturer's facility under industrial conditions. I see no reason why effective repairs could not be made the day after the order is received (only, of course, after changing the present system of economic regualtions).

--Existing configurations should be supplemented with greater operating memories, additional monitors and auxiliary memories, and in the case of powerful minicomputers (such as the MERA 400) operations in the multiprogram and multiaccess modes should become universal. If we take this path, we should achieve significantly better useful results with the limited amount of material and foreign exchange that we have than by producing new configurations. A separate problem is the necessity to implement such economic mechanisms so that the postulated actions would benefit the self-governing work forces of the computer industry.

--In as much as the PDP-11 configurations installed in Poland in most cases also appear in framework configurations that are barely sufficient for user needs, I suggest that the modest foreign exchange funds that will be at users' disposal over the next few years not be used to purchase prepared blocks

abroad but be used to produce additional equipment in Poland in order to use them with the PDP-11 systems already purchased. This can be realized by taking advantage of the work being done on SM minicomputers at the IMM [Institute for Mathematical Machines] Experimental Laboratory.

--Software quality should be improved and the scope of programs generated centrally should be expanded (especially for the MERA 400).

--Relative to the production and development of minicomputers, I believe that now we should place primary emphasis on configurations that are compatible with the PDP-11.

The following possibilities exist here:

--The MERA 60 (SM 50/50-3) is the counterpart of the LSI-11/2 produced by MERA-STER in Katowice using Soviet central processing units.

--The SM 4 is a relatively close counterpart of the PDP-11/40. It can be pruchased in complete configurations from the Soviet Union. It also can be complemented by MERA-CENTRUM in Warsaw using Soviet processors.

--The SM 50/50-1 is the counterpart of the PDP-11-34. A prototype was developed at the IMM in Warsaw with the participation of MERA-PIAP. The following applications of this minicomputer are now envisioned: in bank terminal networks produced by ELWRO, in the new data collection system having expanded capability for local processing (replacement for the MERA 9150) and for applications that must be especially reliable (real-time control) for which the SM 4's reliability parameters would be inadequate. The IMM Experimental Center will produce the configurations for these latter applications.

All three of the above named minicomputers are software compatible and in addition they can use the utility programs developed for the PDP-11 minicomputer which provides many advantages to the users.

In my opinion the viewpoint that one should forsake one's own work on software and limit oneself only to adapting existing software when producing computer hardware that is compatible with products from a known firm is profoundly wrong. Such a viewpoint caused us much harm in applying the RYAD family of computers. In as much as the technical parameters of our hardware, the configurations on hand and economic relations differ in Poland for the original models, it is obvious that, for example, optimal operating systems for original configurations are not at all necessarily the best for our configurations.

Secondly, whoever elects to adopt someone else's solutions will beforehand be condemned to have products that are late in development and that will not be up to date. That is why I believe that industrial programming centers as well as groups working outside industry should work unreservedly on the original SM software which will have the additional advantage that successful products can achieve additional markets in the CEMA countries on SM machines as well as in other countries on PDP-11 machines or those having the same instruction set.

Relative to the MERA 400 computer, one must draw a pragmatic conclusion from the fact that this is a minicomputer having immense calculating power, whose production has been mastered and of which over 400 units have already been sold. I also believe that the previous comment concerning the upgrading of existing configurations should apply especially to this minicomputer. But I would not recommend basing it on the new, interesting utility systems because such systems should be based on SM minicomputers which will guarantee export possibilities.

A separate problem is the question of a future minicomputer which would replace the minicomputers now being produced in Poland. Relative to the features of this minicomputer, it is essential that the following basic assumptions be accepted:

--It should have significantly greater computing power than the models now being produced because in a couple of years microcomputers or programmed calculators will replace the present minicomputers.

--It should be a member of the SM family which guarantees the possibility of its export (even in configurations) within the framework of the CEMA countries.

--It should accept the utility software of existing SM computers as well as of the MERA 400 in order not to leave the users "on ice."

--It must not be a copy or an analog of subsequent DEC series model because, as a result of new designs in electronic technology, the development and production of such copies under our conditions would be economically unprofitable to say nothing of their contradictions.

The most apt proposition in this area is the minicomputer whose concept was presented at the IMM seminar in Warsaw on 24 April 1981 (see INFORMATYKA No 7-8/81). It is obvious that the prospects for its production will depend in a fundamental way on solving the component base problem. Problems to date that have hampered user operations or made them impossible must also be resolved, such as poor quality of hardware, lack of operating material and equipment, service and putting software distribution in order.

Present Status and Development Trends of Information Science

My views as an observer from industry in this area can be highly subjective. Once again I limit my comments to micro and minicomputers.

The quantitative level of micro and minicomputer applications is certainly much lower than the economic and civilization levels achieved by our country and less than the ambitions and capabilities of our computer scientists. I have observed that the application of WANG minicomputers for processing data and calculating, and the PDP-11 computer for control are successful and somewhat of a standard in our country.

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In general, however, minicomputers are not playing the role they should in Poland because of their very small numbers considering the size of the country, of the troubles that users encounter in their operation, mainly with respect to the shortage of data carriers (discettes, disc cassettes and lately paper), and of the incompleteness of configurations as well as the incompetence of service. There is an obvious lack of micro and minicomputer hardware at designers' workplaces (lack of personal computers) and at office workplaces, warehouses, medical clinics, cashiers' desks and the like. The relatively small number of minicomputers that are applied is a result of their high costs and, at the same time, low quality. To a great extent both of these factors are the result of using an obsolete component base.

Once again I emphasize that the development of production in Poland of modern large-scale-integration components is a key problem, and not only because of the needs of information science. It is a strategic problem for the future of Poland. I share the view of those specialists who believe that a country incapable of designing and producing its own integrated circuits within a dozen years or so will decline (if they have not done so already) to the level of a neocolonial country.

If we assume that the component base problem will be solved, then in the area of minicomputers information science's tasks will be:

--To equip the higher schools and a number of secondary schools with minicomputers having modern architectures and software. It is a pedagogical and economic absurdity to train future users and decision makers on obsolete hardware (often scrapped by economic-type ministries) and to expect economic planners to judiciously purchase and effectively use modern hardware. From the very foundations, in the training concepts to date for computer scientists which is not used in any modern country, one can perceive one of the important reasons for the failures of a number of costly computerized information applications purchased in the 1970's from the dollar zones. Let us recall, in view of our capabilities, how sensible it was to have the generation that was trained on the GIERZ and ELLIOTT computers, the world's most modern computers in their class at the time they were purchased for our universities, to design and program the ODRA 1204.

--Design offices, production preparation departments in factories, warehouses and so forth should be equipped with personal computers based on 16-bit micro and minicomputers and the PDP-11 instruction set.

To be sure, most applications will be realized on the Soviet ELEKTRONIKA-60 processor (that is the MERA 60 computer and its derivitives), but very complex applications will be realized on the Polish SM 50/50-1 minicomputer. Of course, the proper compliment of external equipment and auxiliary memories is essential from the viewpoint of the needs of individual users, as well as the development of parametricized utility program packets. The ideal would be that a user would obtain a configuration programmed for his application on which he could execute his tasks without the need to organize a computing center and employing official programmers. To this end, it is necessary to extensively overhaul or reorganize customer service departments and utility programs at the minicomputer buyer's location. We must also consider new, more efficient forms for generating utility programs and designing systems. I believe that the most efficient way to resolve the problem is to organize cooperatives consisting of several or a dozen or so individuals which would bring together system designers and programmers to fill orders at their own work places or at the customer's site. Such projects would not require investments and the cost surcharge on current operations would be minimal. Users would pay the programmers only when they are really needed and not--as currently practiced--from the moment the computer is purchased to the end of its operation.

Once more I emphasize that it is essential that minicomputers reach the user's workplace and not become the embryo for organizing separate computing centers.

--Banks, savings institutions, ticket sales and reservation offices and cash desks in large commercial establishments should be equipped with terminals or computerized cash desks, linked via concentrators--depending on need--to minicomputers or large computers. The SM 50/50-1 can function as the concentrator and minicomputer, and the R-32 computer or its replacement can be the large computer for the desk. Terminals are presently in production at ELWRO.

--Considering the low quality of the processors which we can purchase in the CEMA countries, developing highly reliable real-time systems is especially difficult. Of course, very simple systems based on the INTEL-8080 counterpart can be built and are being built at many Polish centers. Then again, for more complex systems I visualize two sensible paths, namely:

--For systems meant to serve objectives characterized by a large turnover of material or energy use, one can individually produce a higher quality SM 50/50-1 minicomputer by using special aging and component selection techniques as well as by testing subassemblies. Of course such applications cannot be too numerous because of the large costs associated with the construction of such a minicomputer and the difficulties in purchasing materials. This path may be taken to also solve the problems of supplementing and exchanging the many systems purchased in the 1970's in the capitalist countries for various sectors of our economy.

--For the remaining applications (for example, intensive therapy departments in hospitals and control in agriculture) we must await modern components of large and very large scales of integration and good reliability. Without these components we cannot produce cheap and reliable minicomputers in amounts needed for the described applications.

The readers may consider some of the above viewpoints as not too revealing, but I believe they have a right to know the author's viewpoints.

Problems of Unutilized Computers

Szczecin KURIER SZCZECINSKI in Polish 6 Apr 82 p 5

[Article: "About Information Science; Otherwise, Who Wants to Buy a Computer?"]

[Text] As a result of the investigation conducted by the NIK [Supreme Chamber of Control] during the second and third quarters of 1981 at the plant computer centers of the Ministries of Mining, Machine Engineering Industry, Heavy and Agricultural Machine Industry, and Agriculture, it was ascertained that in many cases computer hardware is underutilized.

Very often inappropriate or outright unnecessary purchases are made. Meanwhile, computers and peripheral devices take up space in warehouses waiting for appropriate sites to be prepared or the finalization of installation work which goes on for years.

Ignoring the reasons why the inappropriate purchasing decisions were made, the question arises: What should be done with the hardware? There is no lack of people eager for computers. Second-hand trading is now practically the only way possible; computer hardware is a scarce commodity in Poland.

If it is assumed that owners are storing their computers in warehouses or that those who do not need computerized information centers will want to get rid of the burdensome equipment, then a computer market can be organized.

However, in the opinion of Dr Janusz Gwiazda, director of the Secretariat of the Committee for Information Science, there are not too many people eager to get rid of their hardware. Nonetheless, the secretariat will share information with interested parties on how to sell a given equipment or from whom it can be purchased if need be.

The computer technical-commercial enterprise, which has been in operation over one month and which is based on the central office of the former information science association, a paid intermediary in computer hardware transactions, provides professional advice and estimates equipment value.

Computers are not easy to trade. Each user requires a given computer configuration along with its applied equipment. Thus the reselling of this apparatus is limited. For example, Wroclaw Polytechnic would like to get rid of a RYAD-32 computer which has non-standard, no-longer-in-production packets and a small-capacity memory.

As stated in the NIK report, thoughtless purchases of computer equipment caused much damage to the economy. For example, computer equipment to control a rolling process and worth over $11 million was purchased in the U.S.. After the equipment was obtained, the hot-rolled sheet rooling mill was not built and the computer equipment not used. This computer system is designed to meet the requirments of a specific process in a specific industrial enterprise. Thus, who will buy it?

Up to the time of the inspection, Austrian computers purchased in 1978 and worth 27 million zlotys were not being used.

The NIK report states further that as of the end of May 1981 the Warsaw MERA-Prefal enterprise for Industrial Automation had 19 Polish-made MERA-300 minicomputers worth 45 million zlotys purchased during the 1974-1979 period that are not being used. Will MERA-Prefal find a buyer for these already obsolete computers and, what is more, be unhappy with the high reputation of the users?

The NIK investigated only a few ministries. No doubt incidents of nonutilization of equipment occur in other ministries.

This needlessly purchased hardware described in the report does not probably represent a problem that is too troublesome, states Director Gwiazda. In another case its owners turned to the Secretariat of the Committee for Information Science for help to get rid of their equipment.

The Ministry of Science, Higher Schools and Technology to whom the mentioned Secretariat is subordinate and which is now supervising information science affairs in Poland, is counting on increased activity in used computers after various economic units pass completely over to a self-financing basis. Thus, in this case, the reform is supposed to perform miracles. But, what mechanisms will bring about the transfer of tens of computer systems located in directors' private offices, even in the Ministry of Science?

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ACCOMPLISHMENTS OF EMINENT PHYSICIST OUTLINED

Sofia NARODNA KULTURA in Bulgarian 23 Apr 82 p 2

[Article by Prof Dr N. Martinov, Docent, Candidate of Physical Sciences Iv. Lalov, Docent, Candidate of Physical Sciences Kr. Germanov, and Senior Science Associate and Candidate of Physical Sciences A. Konova, instructors on the Chair for Solid State Physics under the Kl. Okhridski Sofia University: "An Inspired Scientist and Citizen"]

[Text] Corresponding Member [of the Bulgarian Academy of Sciences], Prof Milko Borisov is one of the founders of solid state physics in Bulgaria. He is the creator of a scientific school of acoustical electronics and acoustical optics in Bulgaria. This is a new and rapidly developing area which involves important areas of modern physics and engineering including microelectronics, microwave acoustics and integrated optics. The comprehensive and profound research of Prof M. Borisov are of important fundamental and applied significance. His contributions and pioneering have been repeatedly praised highly by prominent scientists in the USSR, the United States, the GDR, FRG and England.

The works for which Prof M. Borisov has been proposed for the Dimitrov Prize are two peak achievements in the Bulgarian school of acoustical electronics. The first work relates to the observance of a new phenomenon in acoustical electronics. In interacting with electron fluxes, the waves of flexure ["oguvane"] in monocrystal wafers are amplified. On the basis of this phenomenon, new types of resonance transistors have been experimentally studied and developed and they satisfy the requirements of microelectronics. This work is based on new methods of measuring small mechanical oscillations successfully realized in the present research of Prof M. Borisov and his co-workers. The second work shows the possibility of employing quartz piezoelectric resonators for frequency metering with maximum high accuracy. This makes it possible to measure the physical amounts with very great sensitivity. The new laser velocity meter proposed by the co-workers of Prof M. Borisov is based on this principle. This work establishes the beginning of a new area in instrument building.

All the work of Prof M. Borisov shows an important essential trait in his scientific creativity, that is, the scientific achievements should be introduced into practice! He is profoundly convinced that science has true value and strength only if it is directly linked to the needs of life and society. This view has been the driving force in the active career of the scientist and his criterion for evaluation and

self-evaluation. He instills this profound civil feeling in his students and co-workers.

The biography of Prof M. Borisov would not be complete if mention were not made of other aspects of his activities. He has done enormous work in the area of physics education and he has been the inspirer and instituter of modernizing the physics course in the secondary schools, the indoctrinator and leader of the young scientific personnel on the Physics Faculty of Sofia University and the creator of the specialization [major] in solid state physics. Prof M. Borisov is the director of the Unified Physics Center and the Institute for Solid State Physics under the Bulgarian Academy of Sciences, the leader of national programs and the creator of the international school for condensed-state physics operating permanently in Bulgaria.

By any criteria the scientific activities of Prof M. Borisov merit the Dimitrov Prize, which is high social recognition for the scientific achievements and total dedication of this talented scientist and citizen.

10272
CSO: 2202/11

DEVELOPMENT OF COMPUTER SYSTEMS REVIEWED

Estel Teleprocessor Family

Sofia TEKHNICHESKO DELO in Bulgarian 24 Apr 82 pp 1, 4

[Article by Engr Yulian Danchev: "The Estel Family"]

[Text] The aim of the Estel Project was to develop, introduce and produce systems for teleprocessing and a multimachine network. It was developed by the following collective: Senior Science Associate Zhivko Zhelezov, leader, Senior Science Associate Venko Markov, Senior Science Associate Ilich Yulzarn, Engr Nedko Zhelevski, Senior Science Associate Stoyan Markov, Engr Venelin Altunov, Engr Svetla Basmadzhieva and Senior Science Associate Koycho Vitanov.

If the thesis is correct that the importance of a scientific achievement must be judged primarily from the benefit that it brings society, undoubtedly the developers of the Estel Teleprocessing System have rightly been submitted as candidates for the 1982 Dimitrov Prize. The success of their many years of work has many ramifications, the most important of which is the economic effect. A special plant has been created for producing the Estel and its products are exported without competition to many nations. Up to now over 200 systems have been sold in the USSR alone. They are evermore widely being employed in our electronic computer centers and systems for production and management automation in order to greatly expand their capability for flexibility, efficiency and coverage.

The idea of the Estel arose when it became clear that the future belonged to computers operating on real time. Only with their aid would it be possible to realize automated control systems for production processes where the information on the object's current state had to immediately cause a control action. This meant first of all that man had to be excluded from the collecting and inputting of the data. As a result the purely technical problem arose of the dependable and rapid transfer of information from the place it arose to the computer complexes as well as the reverse transmission of the control action to the servomechanisms. With the present form of industrial production (both in technical and managerial terms), the components of the individual production systems and subsystems, as a rule, are scattered over great distances. This excludes the possibility of directly utilizing the simple and widespread telephone and telegraph lines for transmitting the data to the computers and back. As a result, the necessity arises of equipment and hardware which can "mediate" between the computers and the distant data sources such as

pick-ups, telexes and so forth. There thus arose the first modifications of the Estel which made it possible to connect a large number of remote terminals to the computer installations over the switchable and nonswitchable telephone and telegraph lines, thus eliminating the harmful influence of distance. This was a great accomplishment, although, as we will see, it subsequently turned out that it would have been better to solve the reverse problem, that is, the computers should have been spread out and brought closer to the data sources. In order to do this it would have been necessary to develop new technical capabilities and program components which at the time of Estel-2 were unknown. However the case, precisely the modifications Estel-2 and Estel-2.1 were vitally essential, rationally and effectively usable and thus became widespread. Their basic configuration included the ES-8401 multiprocessor which was developed in order to make it possible to connect all the models of computers of the Unified Series (ES-1022, 1030, 1033, 1040 and 1050) with all types of terminals of the ES-8501 type as well as with the telex equipment produced in the GDR and CSSR, the Hungarian video displays and so forth. The basic unit in the system is the data sets [modems] developed and produced in a range covering virtually all possible speeds which are employed in data transmission.

The software of the system is of particularly important significance for all the Estel modifications. In addition to providing its complete compatibility with all equipment of the Unified Series (adopted by the CEMA countries), precisely the software gives the system that universal applicability which makes it equally suitable at industrial enterprises as well as in rail, motor and air transport, both in the ministries as well as institutions of higher learning, hospitals and so forth. The software is based on products such as the base telecommunications access method (BTAM), the telecommunication sequential access method (KTAM) and the dialogue terminal system (DTS). We must specially mention the data flow control system (SUIP) which, although being developed for other purposes, makes it possible to use the branched terminal network of Estel for operating on real time. It must be realized that Estel owes its great functional capabilities and universality precisely to the first-rate software developed for it by the developers.

At the same time the requirements of modern production processes for ever-greater speed and accuracy have grown quickly and this has raised the issue of full automation as an urgent necessity in all spheres. This has meant (aside from all else) the encompassing of evermore production and management equipment in widely branched and complicated automated systems. In this new situation the principle of centralized data processing has begun to become ineffective. The increase in the data flows and their density logically leads to a decline in the speed of the automated system and this in and of itself contradicts the very reasons for its development. The central computer had to be freed and for this new hardware and software were needed by which the computer resources could be dispersed over the entire territory encompassed by the automated system. Moreover, the necessity arose of connecting the individual automated systems and particularly their dispersed computer equipment into automated installations of a higher order. Thus, two important problems would be solved: the effective and direct redistribution of the computer resources from the viewpoint of their optimum load factor and the automated exchange of data between systems which was particularly important with hierarchical structures.

The practical realization of such a concept was fundamentally impossible without a corresponding teleprocessing system and this meant a new Estel created from

telecommunication processors and intelligent terminals. The developers of Estel must be congratulated as they responded promptly to the new demands and as a result of this Estel-4.1 appeared. This already was an installation for remote data transmission and processing which applied new operating principles, new hardware and improved hardware and software diagnosis. The structure and organization of Estel-4.1 is based upon the concept and architecture of network teleprocessing in which local computer capability predominates. As a result the system has a number of advantages which are expressed in increased speed, effective use of communications lines and the freeing of the central computer.

Of particular importance for the actual use and rapid spread of Estel-4.1 is its capacity to emulate all the functions of Estel-2 and Estel-2.1 without making any changes in the organization of the hardware. The developers of Estel-4.1 have correctly understood the great economic significance of emulating (encompassing) the old system's functions by the new one because with the use of a large number of the previous modifications of Estel, the expanding of the automated systems of which they were a part and particularly the converting of them into computer networks would mean the large-scale abandoning of usable and expensive equipment. In truth, in the emulation mode, the Estel-4.1 does not employ all its computer and functional power but the benefit from maintaining the status quo is very great. In this regard the accomplishment of the collective which created the capacity for emulation must be particularly pointed out. In practice this mode is realized by carrying out the emulation program by the ES-8371 telecommunication processor which in turn is a basic part of the system.

Also characteristic for the hardware of Estel-4.1 is the availability of a number of new technical devices. In addition to the telecommunication processor (photo 1 [not reproduced]), the system includes an IZOT-7925 video terminal (photo 2), a SM-1604 video terminal (photo 3), a SM-1605 miniterminal (photo 4) and others. It is equipped with a developed system of program diagnostics and with on-line tests which operate under the control of the operational testing system (SOT) and the internal functional test (VFT) for all units. In addition, the control program of the telecommunication processor includes software for the dynamic testing of the communications lines during operating time.

In conclusion it can be said that the Estel-4.1 is a talented and enormously practical interpretation of the moden notion of realizing computer processes through computer networks and multimachine systems. Along with the previous modifications of Estel, they represent a substantial contribution to the development of Bulgarian computer equipment and particularly to increasing the effectiveness of its use in automated control systems. Equally important, the appearance of Estel substantially broadens the export capabilities of the nation in an area where Bulgaria has already indisputed authority. This has been the result of creative persons among whom a worthy place is held by the developers of Estel.

Data Preparation Units, Systems

Sofia TEKHNICHESKO DELO in Bulgarian 24 Apr 82 pp 1, 5

[Article by Engr Aleksandur Kostov: "Data Preparation Units and Systems"]

[Text] The aim of the project was to develop, introduce and produce a family of data preparation units and systems for electronic computers. The developers

included: Senior Science Associate and Candidate of Technical Sciences Tikhomir Topalov (leader), Engr Leon Mairov, Engr Vitko Elenkov, Engr Aleksi Aleksiev, Engr Branimir Buyukliev, Engr Lilyana Taneva, Candidate of Technical Sciences, Engr Atanas Mikhaylov and Engr Vladimir Chervenakov.

Many call our age the electronic age, in pointing to one of its offspring, the electronic computer. It would truly be difficult to imagine today (and even more tomorrow) without it. It would also be difficult to mention any other area of science and technology where achievements are so quickly out of date. The designers have merely to "neglect" one of its numerous devices to turn this into a weak point of the entire system. At the end of the 1960's, the problem arose of preparing the data which would be processed by computer. At present, no one in the world underestimates it. Statistics show that over 50 percent of the expenditures in operating a computer go for preliminary processing of the primary data and this percentage has been constantly increasing. During the last decade in our Institute for Computer Engineering under the leadership of Senior Science Associate, Candidate of Technical Sciences Tikhomir Topalov, a family of data preparation units and systems has been developed. The 14 inventions embodied in them show their high technical level. The importance of this fact is reinforced by the circumstance that when we began to design the units the nation did not have any experience whatsoever in developing data preparation equipment.

In essence everything started by a trip abroad. We got a feeling, as is said, for the direction in which the wind was blowing and quickly the research was brought into line with modern trends. The aim was obvious: to develop devices with magnetic carriers (tape and discs) which would replace the unproductive punch-card equipment which no longer met the requirements. The first Bulgarian unit for preparing data on magnetic tape, the ES-9002, was developed in a record short time. In 1972, this was completed and it went into regular production the following year. Significant numbers of this unit were exported to the USSR, Hungary, India, Yugoslavia and elsewhere. It also received a number of awards: gold medals at the fairs in Plovdiv (1973) and Brno (1974), the diploma and gold emblem of the national review of the TNTM [Movement for Youth Technical and Scientific Creativity] (1974) and the diploma of the DKNTP [?State Committee for Scientific and Technical Progress] (for its modification the ES-9002.02 in 1977). The unit was marked by original approaches which put it above its Western competitors, including: the control of the tape drive mechanism and keyboard, the timer, the layout of the keyboard, size, weight and so forth. It embodied five inventions. In 1977, a commission of experts from several nations gave it a higher evaluation than an analogous U.S.-produced product. Over the years, the unit has been developed and the first modification appeared, the ES-9002.01 (in addition it had the "data unification" function), and subsequently a second modification, the ES-9002.02 (with one other "data print" function). But the decisive modernization came later when on the basis of the ES-9002 the ES-9004 was developed. As the specialists say, the basic difference is in its increased intelligence. The new unit which also employed a magnetic tape was ready in 1980. During the same year, it went into regular production. An international commission again noted its better parameters in comparison with its American competitors. In the unit a number of the designs are protected by certificates of invention. The modifications, the ES-9004.01, the ES-9004.02, the ES-9004.03 (photo 1 [not reproduced]) and the ES-9004.04, widen its functional capabilities and hence its area of application.

At the same time, needs have suggested another area of work, the multiconsole data preparation systems which are effective in instances when many individual units of the ES-9002 or ES-9004 type are needed. Thus, in 1977, the ES-9003 system was developed (photo 2) and this is a problem-oriented computer installation which includes a miniprocessor, monitors and peripheral units. The data are input through 16 video keyboard consoles, they are stored in a minidisc memory and after processing are fed onto magnetic tape or are printed out. The system has been in regular production since 1978. During the same year it received a gold medal at the Plovdiv Fair and in the following year a silver medal at the Moscow Exhibit "Computer Equipment of the Socialist Countries." In 1979, a variation of the system was developed with a telecommunication adapter and this made it possible to transmit the data directly to the central computer. In 1980, the ES-9003 was incorporated as part of the Estel-4.1 teleprocessing system as a synchronous terminal station.

The ES-9005 represents the further development of multiconsole systems and this unit realizes the modern concepts of decentralized data preparation. In it there are 32 consoles for inputting the data. State testing of the system has been successfully concluded and it has been put into production.

Simultaneously with the development of magnetic-tape data preparation units, units have been developed which operate on a floppy magnetic disc. This is the ES-9112 which was designed on the basis of the SM-600 microprocessor family. This is one of the first units in Bulgaria which has been developed on the basis of large integrated circuits. Its international testing has been successfully concluded. Its continuation has been the ES-9113 which has the possibility of re-recording information from a floppy magnetic disc back onto magnetic tape and vice versa. The unit embodies two inventions. A trial series was manufactured in 1980.

The ES-9114 (photo 3) "succeeded" the ES-9002 and the ES-9004, but the carrier is a floppy magnetic disc. It was completed in 1981, in the same year it successfully underwent international testing and at present is beginning regular production. Three inventions are embodied in it.

If one must make a final reckoning, the following advantages of the new data preparation units and systems will become apparent: an enormous amount of paper, machine time and equipment is saved. For example, the ES-9002 replaces a key punch, a monitor and a punch-card reader. Something very important is that the productivity using the units of the family averages 60-140 percent higher than the key punches. Operating expenses are less while reliability is substantially increased. The high technical level of the developments has made it possible for our nation to hold leading positions in this area among the socialist nations and throughout the world.

10272
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PRECIOUS METALS CONSERVATION IN ELECTRONICS, ELECTRICAL INDUSTRIES DESCRIBED

Prague SDELOVACI TECHNIKA in Czech No 2, 1982 pp 41-44

[Article by Eng Hana Simanova: "The Designers' Task in Thrifty Use of Precious Metals in Electrical Engineering and Electronics"]

[Text] Thrifty use of metals is currently a top-priority national economic task. Accordingly, one of the state special purpose programs for the Seventh Five-Year Plan is a program for increasing the efficiency of metal consumption (SCP-RSK-03), which deals with the task in a comprehensive manner by including the metal processing sector within its scope. Long-term analysis indicates that design work unquestionably plays the critical role in decreasing materials requirements in the production cycle. The importance of this work and the irreplaceable role of designers and manufacturing engineers also found an echo at the 16th CPCZ Congress.

The design which a designer selects determines not only the technical characteristics of the future product or piece of equipment, but also metal consumption per unit, which is now of especial importance to us. Accordingly, the following reflections, focusing primarily on precious metals (specifically gold and silver) are directed chiefly at designers and manufacturing engineers in the electrical engineering and electronics industries.

In the last century precious metals and their alloys were used almost exclusively for decorative purposes. As industrial production developed and science and technology progressed, however, they have become an increasingly important modern industrial materials, which accounts for the increase in their use. For example, 95 percent of the silver and 58 percent of the gold (i.e., the bulk of total annual consumption) processed in Czechoslovakia are used for technical purposes. Most of this metal is used in electrical engineering, where the special physical and chemical properties of silver and gold make them indispensable to the industry's current level of technical development.

The Uses of Silver in Electrical Engineering and Electronics

Its suitable physical and chemical properties and its more favorable price in comparison with other precious metals result in an increasing use of silver, particularly in the production of electrical contacts and functional

coatings for a great variety of parts and assemblies in electrical engineering and electronics, and as an alloy addition in the production of solders.

Silver Electrical Contacts

Electrical switching component (contacts), which are an essential part of almost all electrical devices and equipment, are subject to increasingly stringent requirements as regards their reliability and durability. These requirements, combined with the suitable properties of silver, make it, its alloys and its sintering products essential components of electrical contacts. Naturally, then, ever-increasing amounts of silver are being used. But the shortage of raw materials and particularly the steady rise in the price of silver are forcing contact material producers and users to decrease silver consumption per item in order to make maximum use of the metal.

We may cite the following possibilities for conserving silver as a contact material.

The use of plated materials (by "plated material" we mean a material consisting of two layers of different metals joined by hot or cold rolling). In recent years the Safina National Enterprise in Vestec, in cooperation with VUK [Metallurgical Research Institute] in Panenske Brezany has been able to introduce industrial plating of base metals with silver or its alloys. In the case of contact materials the objective is to replace most of the nonfunctional section of the material with a base metal (largely copper or its alloys). Another advantage is the fact that use of plated materials also makes it possible to take advantage of the more suitable mechanical properties of the substrate materials, which often are superior to those of the contact materials. At present the Safina Vestec National Enterprise, the sole producer of precious metal semifinished products, is producing the items noted in Tables 1a-1e. An example of the use of plated materials is the plated contacts in relay switch circuits. Before this technology was introduced, the contacts were all-silver, but the substitution of plated materials decreased silver consumption by about 70 percent. Fig. 1b is a diagram of a plated contact. The quality, durability and functional capabilities of the design are equivalent to those of the earlier design.

[Tables and keys on following pages]

Základní materiál a	ČSN b	Naplátovaný materiál c	ČSN b	Rozměry d	
Cu99,9	42 3001	Ag ryzí e	42 3830	šíře pásů max. 110 mm, ≠ pásů 3—0,2 mm, ≠ naplátované vrstvy 1—0,1 mm	f
Ms90	42 3201	AgNi 0,14	—	šíře pásů max. 90 mm, ≠ pásů 3—0,2 mm,	
Ms80	42 3203	Ag ryzí	42 3830	≠ naplátované vrstvy 1—0,1 mm	g
Cu99,9	42 3001	AgPd30	42 3838	šíře pásů max. 60 mm, ≠ pásů 2—0,20 mm,	h
Ms90	42 3201	Ag90Cu	42 3834	≠ naplátované vrstvy 1—0,1 mm	
Ms80	42 3203				
CuSn6	42 3016	Ag ryzí AgNi 0,14	42 3830	šíře pásu max. 50 mm, ≠ pásů 3—0,20 mm, ≠ naplátované vrstvy 1—0,1 mm	i

Table 1a. Strips fully plated on one or both sides

Key:
a. Base material
b. Czechoslovak State Standard
c. Plating material
d. Dimensions
e. Pure Ag
f. Maximum strip width 110 mm, strip thickness 3-0.2 mm, thickness of plated layer 1-0.1 mm
g. Maximum strip width 90 mm, thickness of strip 3-0.2 mm, thickness of plated layer 1-0.1 mm
h. Maximum strip width 60 mm, thickness of strip 2-0.20 mm, thickness of plated layer 1-0.1 mm
i. Maximum strip width 50 mm, strip thickness 3-0.20 mm, thickness of plated layer 1-0.1 mm

Základní materiál a	ČSN b	Naplátovaný materiál c	ČSN b	Rozměry d	
Cu99,9	42 3001	AuNi5	42 3803	šíře pásů e	56 mm
CuSn6	42 3016	AuAgNi3	—	šíře plát. vrstvy f	14,5 mm
Ms90	42 3201			≠ pásů g	0,20 mm
Ms80	42 3203			≠ plát. vrstvy h	0,05 mm

Table 1b. Strips plated on one side

Key:
a. Base material
b. Czechoslovak State Standard
c. Plating material
d. Dimensions
e. Strip width
f. Width of plated layer
g. Thickness of strip
h. Thickness of plated layer

Základní materiál a	ČSN b	Naplátovaný materiál c	ČSN b
Ms70	42 3210	Ag ryzí 99,9 d	42 3830
Ms68	42 3212	AgNi0,14	—
Ms63	42 3213	Ag96,5Cu	—
MsNi14	42 3256	AgPd30	42 3838
CuSn6	42 3016		

Table 1c. Strips with plated bars above the level of the base material ("Toplay")

Key:
a. Base material
b. Czechoslovak State Standard
c. Plating material
d. 99.9% pure Ag

Základní materiál a	ČSN b	Naplátovaný materiál c	ČSN b	Rozměry d	
Cu99,9	42 3001	Ag ryzí 99,9	42 3830	šíře pásů max. 110 mm, šíře 1 inlaye 50—5 mm,	f
		Ag90Cu	42 3834	≠ pásů 2—0,2 mm, ≠ inlaye 1—0,01 mm	
		AgNi 0,14	—		
		AgPd30	42 3838		
Ms90	42 3201	Ag ryzí 99,9	42 3830	šíře pásů max. 90 mm, šíře 1 inlaye 50—5 mm,	g
Ms80	42 3202	Ag90Cu	42 3834	≠ pásů 2—0,2 mm, ≠ inlaye 1—0,01 mm	
		AgNi 0,14	—		
		AgPd30	42 3838		

h Maximální počet pruhů: 5 do celkové šíře 50 mm

Table 1d. Strips with bars inlaid into the base material ("Inlay")

Key: a. Base material
b. Czechoslovak State Standard
c. Plated Material
d. Dimensions
e. 99.9% pure Ag
f. Maximum strip width 110 mm, width of one inlay 50-5 mm, thickness of strip 2-0.2 mm, thickness of inlay 1-0.01 mm
g. Maximum strip width 90 mm, width of one inlay 50-5 mm, thickness of strip 2-0.2 mm, thickness of inlay 1-0.01 mm
h. Maximum number of bars 5, total width up to 50 mm

Jádro a	ČSN b	Plášť c	ČSN b	d
Ag 99,9	42 3830	AgPd30	42 3838	ø drátu 0,50—0,60 mm tloušťka stěny 0,05 ± 0,03 mm

Table 1e. Plated wires

Key: a. Core
b. Czechoslovak State Standard
c. Plated layer
d. Wire diameter 0.50-0.60 mm, wall thickness 0.05±0.03 mm

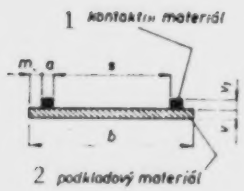

Fig. 1a. Figure to accompany Table 1c.

Dimensions: a, 1-4 mm; b, 4-90 mm; v_1, maximum 0.6 mm; v, 0.4-1.5 mm, m, minimum 1 mm; s, minimum 6 mm

Key: 1. Contact material
2. Substrate material

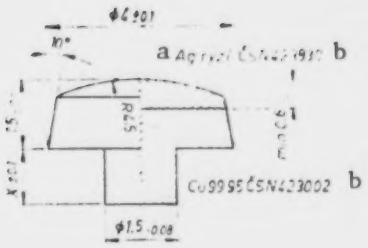

Fig. 1b. Plated contact

Key: a. Pure silver
b. Czechoslovak State Standard

Miniaturization of contacts and optimization of their form is another logical way of saving silver. The designers must attempt to design contacts of a shape which uses no excess contact material. For example, SEZ [Slovak Electrical Equipment Plants] Krompachy has replaced square contacts with round ones, saving several million korunas worth of silver.

New contact materials. Yet another possible means of conservation is more rapid development and introduction into production of new contact alloys and sinters with a lower precious-metal content but the same quality. An example is a sinter based on AgCdO, in which the presence of finely-dispersed CdO decreases contact wear. Also very promising is the $AgSn_2$ system, which can save up to 30 percent on silver.

Silver Coatings

There are many techniques for producing silver coatings on metals and dielectrics. The most widely used is electrochemical deposition of a silver or silver-alloy coating on a metal substrate, generally in order to increase its electrical conductivity.

There are several ways of making better and more efficient use of silver on electroplating, including the following.

Suitable choice of and adherence to thickness specifications. Coating thickness specifications must be based on a good knowledge of the properties of the plating material, the requirements applying to the part in question, the required durability and reliability, and the conditions under which the part will operate. Since choice of thickness is affected by several different, variable factors, the correct choice should be based on technical and economic analysis which stringently adheres to the aim of efficient use of silver. TESLA standard NT 1501 provides guidance for the choice of silver coating thicknesses in terms of location categories, i.e. extent of corrosive load.

Producibility of designs. Since the age of the "jack of all trades" has passed, close cooperation between the designer and surface treatment engineer, particularly at the initial design concept stage, should become a regular practice. While it is the custom for designers to consult with manufacturing engineers on the best machining shapes, this is not the case in the production of metal coatings, where the producibility of the design plays an important role in the plating process. It should be borne in mind

that if a component's shape is not suitable for plating, the plating process cannot be expected to be of high quality and cost-effective. But in some cases we fail to avoid pieces of complex shape. A typical example is the silver-coating of the inner surfaces of waveguide components, where the use of interior anodes is essential for high-quality, economical plating. On the basis of experimental measurements, TESLA Hloubetin has developed a simple procedure for determining the size and dimensions of anodes required for silver-coating the inner surfaces of conduits with a maximum length of 1200 mm and a minimum diameter of 20 mm.

Replacement of silver coatings by base metal coatings. In some cases silver-coating is continued only out of tradition with no technical justification. A typical example is the practice, common until recently in some organizations, of silver-coating to improve the solderability of parts or connections (soldering lugs, rivets). In most cases the requirement for a permanent joint can be fully met by substituting tin-plating.

Choice of the right type of silver-plating electrolyte. The critical factor in choosing the right type of bath is the required properties of the plated surface, particularly electrical conductivity, hardness, wear resistance, reflectivity and the like. On the basis of these considerations we classify silver electrolytes as those which produce a coating of pure silver (bright or matte finish) and those which produce alloy surfaces in which some silver is replaced by base metal.

An electrolyte with the trade name Syngal 710 (produced by BAL [expansion unknown] Uhrineves is commercially available in Czechoslovakia for the plating of matte pure silver surfaces; bright pure silver coatings are plated primarily with imported electrolytes. For example, TESLA's enterprises have had good results with the electrolyte designated R105 (produced by Riedel). The domestic electrolyte Syngal 720 is the primary one used in Czechoslovakia to produce alloy coatings. This produces coatings containing antimony (1 to 3 percent), which may be applied in any case where high wear resistance is required, but it must be borne in mind that the antimony decreases electrical conductivity.

Choice of suitable corrosion protection for silver. Suitable corrosion protection of silver against corrosion (blackening) does not, of course, result in conservation in absolute terms, but the correct choice of corrosion protection can increase the durability of the plated products, thus indirectly saving silver. A number of techniques to prevent blackening are in use. Almost the only way of assuring permanent corrosion resistance while maintaining good conductivity is the application of a laver of a more precious metal, e.g. gold, palladium or rhodium, 0.1 to 1 micron thick; if we also wish to assure good-quality soldered junctions, application of a layer of gold is most suitable.

Application of silver coatings only at functional locations. Recently the technology of partial (local) selective silver-coating has come into use in the production of silver coatings. The principle is that locations which do

not require a coating, i.e. nonfunctional locations, are covered by a mask (varnish or a mechanical mask) and so that the electrolyte comes in contact only with the exposed parts of the item to be coated.

Silver-Containing Solders

Another aspect of the use of silver in the electrical industries is silver solders, whose sole producer in Czechoslovakia is Safina Vestec. The silver content of these solders ranges from 15 to 85 percent by weight. The great strength and generally good deformation properties of the joints, their corrosion resistance, excellent thermal and electrical conductivity, good wettability during soldering and relatively low operating temperatures have won them extensive use in electrical engineering. Here too there is potential for thrifty use of silver, including use of the following methods:

a. suitable treatment of the pieces to be joined,
b. soldering conditions,
c. replacement of high-silver solders by low-silver solders or use of base-metal solders.

Table 2 presents general information on silver-containing solders, which should be given particular attention in order to make efficient use of precious metals. [Table 2 and key are shown on the following page.]

Use of Gold and Its Alloys in Electronics and Possibilities of Decreasing Gold Consumption

The microelectronics industry is the main consumer of gold in the electrical field. The sharp increase in output in this sector has resulted in increased consumption of gold, which to date has been irreplaceable in many aspects of the design of microelectronic components.

In designing microelectronic components it must be borne in mind that the gold cannot be recovered after the components are worn out because it is dispersed in minute quantities among huge numbers of parts or assemblies, so that recovery would be time-consuming and difficult. A more effective approach is to find and use designs and processes minimizing the use of gold.

Functional Gold Coatings

About 85 percent of all of the goal consumed by the electronics industry is used for functional surfaces, mostly electrochemically produced. These include integrated circuit strip elements, transistor pins and planar connectors. A variety of requirements apply to gold coatings, ranging from the plating of ultrapure, surfaces with good solderability and contact quality and high temperature resistance to the production of surfaces with maximum wear resistance and minimum contact resistance.

Table 2. Solders with low precious-metal content

a Pájka	b Chemické složení				c Interval tavení °C	d Pracovní teplota °C	e Mechanické vlastnosti spoje				Běžně dodávaný tvar j
							základní materiál ČSN 42 3005 f		základní materiál ČSN 17 246 g		
	Ag	Cu	Zn	Cd			pevnost v tahu N/mm² h	pevnost ve střihu N/mm i	pevnost v tahu N/mm² h	pevnost ve střihu N/mm² i	rozměry v mm i
PAg15CuP	15	80	P 5	—	700—635	710—800	160—220	110—160	—	—	pásy k 0,2 × 10 a 100 pruhy l 1 × 10 × 500
PAg40CuZnCd	40	19	21	20	630—595	640—680	170—220	70—120	320—370	100—160	pásy 0,4 × 10 a 100 k tyče tvář. ø 2,0 × 1000 m dráty ø 1,6 a 2,0 n

Key:
a. Solder
b. Chemical composition
c. Melting range, °C
d. Working temperature, °C
e. Mechanical properties of joint
f. Base material, Czechoslovak State Standard 42 3005
g. Base material, Czechoslovak State Standard 17 246
h. Tensile strength, N/mm^2
i. Shear strength, N/mm
j. Form in which usually sold: dimension in mm
k. Strips
l. Bars
m. Rods 2.0 mm diameter x 1,000 mm
n. Wire 1.6 and 2.0 mm diameter

PAg15CuP Solder:

Usable for copper-to-copper soldering without flux; particularly suitable for soldering electric contacts, in the production of cooling equipment transformers and the like. Rapid heating and a narrow gap (0.07-0.12 mm) necessary to assure a firm joint. Not recommended where appreciable subsequent forming of the soldered object is planned. With flux (FB11-31), can be used with simple copper alloys (brass, bronze and the like). Not usable with nickel and its alloys, iron or any type of steel; for these purposes, PAg40CuZnCd is suitable.

[Table 2, continued]

PAg40CuZnCd

Usable with iron, low and high alloy steel, stainless steel, sintered carbide, nickel and its alloys, copper and its alloys, precious metals. This is a special silver solder, with the lowest melting range and working temperature, minimizing heating time. Particularly suitable for series and mechanized soldering. For delicate soldering of small components with narrow gaps, thin films, pipe, pipe nipples, connections to copper wire and cable, fittings, tools with high-speed steel and sintered carbide tips, surgical instruments, optical instruments, cooling equipment, electroplated brass musical instruments, production of lamps, lamp fittings and the like. Not recommended for wider gaps (PAg25CuZn and PAg30CuZnCd are more suitable for these purposes), or for soldering of plain cadium, e.g. for the foodstuffs industry (PAg45CuZn, PAg60CuZn and PAg66CuZn are suitable for these purposes). Harmful vapors must be exhausted during soldering.

Because no "ideal" electrolyte, capable of meeting all these requirements, has been developed, a large number of gold-containing electrolytes are offered, primarily by foreign producers. A good knowledge of the properties of plated surfaces and a sense of responsibility on the part of the designer or developer are essential for selection of the gold-plating electrolyte which will maximize conservation of gold.

The possibilities for conservation of gold used in the production of functional surfaces includes the following.

Local plating. The principle on which this method is based was described in the section on silver plating. Its use can decrease gold consumption by about 90 percent, in view of the ratio of functional surface area (switching and contact surfaces) to nonfunctional area. But in large-scale production this approach usually requires special fast-plating electrolytes and complex equipment. The technology is not yet so widely used in Czechoslovakia as it should be; it would be desirable to use it on the same scale as in other countries. With its use, the way is opened for designers to cooperate with manufacturing engineers in working out ways of saving scarce metals. One example of the use of local coating technology in Czechoslovakia is the gold-plating of contact strips for direct and indirect connectors (see Fig. 2). The functional surface is only a tenth of the total surface area of the connector.

Fig. 2. Shapes of contact strips for direct (a) and indirect (b) connectors; the functional surface is indicated by broken lines.

Lower-Purity Gold Coatings

Alloyed gold coatings, in which part of the gold is replaced by a base metal, are suitable for use in the gold-coating of design components, and particularly connector components, for electronics (e.g. contact strips for connectors). The coatings have a greater hardness and wear resistance than pure metal coatings. Several electrolytes which produce low-assay coatings are available on foreign markets. A gold-cobalt-nickel coating with a purity of 96-98 percent (Aurosaf electrolyte, produced by Safina Vestec) is commercially available in Czechoslovakia. However, this electrolyte has some drawbacks, primarily low current efficiency (the effective amount of current used to deposit the metal is about 35 percent) and the production of nonuniform coatings. These drawbacks have been eliminated by a newly developed electrolyte which is now undergoing semi-industrial tests. This is an Au-Cd (0.295% Cd) alloy electrolyte whose main advantage over the Aurosaf electrolyte is that it deposits coatings of uniform thickness and consumes less energy; the current efficiency is about 95 percent. The advantages of this electrolyte suggest that a saving of 15 percent might be realistically obtainable if it were used to coat planar contacts.

Selection of Gold Coating Thickness

Because of the scarcity and high price of gold, the thicknesses of gold coatings must be chosen with even greater care than in the case of silver. Just as in the case of silver coatings, there is still no Czechoslovak State Standard governing the thicknesses of gold coatings. In general terms, we may say that the thickness of gold coatings for most connector components ranges from 2 to 5 microns for both pure or alloy coatings. These figures are in accordance with a proposal prepared by ISO according to which the thicknesses recommended for gold coatings for engineering purposes are 0.5, 1, 2.5, 5 and 10 microns. This draft also admits the use of other thicknesses, but the minimum thickness is 0.5 microns.

The use of an intermediate nickel layer in gold-plating is another possible way of decreasing gold consumption. The nickel undercoat makes it possible to decrease the thickness of the gold coating by a few microns, because nickel creates a diffusion barrier between the plated metal and the gold coating. For example, the use of an undercoat of nickel 3 to 5 microns thick would make it possible to decrease the thickness of the coating from 7 microns to 3.5 microns while maintaining the same connector durability.

Gold Contacts

A smaller quantity of gold is used in electronics in the massive form. This is used primarily for contacts in low-voltage and measuring technology for currents between 5 and 100 mA (maximum 1 A) and voltages of 12 to 60V. The gold alloy AuNi5 (5 percent nickel) is most frequently used for this purpose. But recently, contact materials using AuAgNi have been developed and have undergone industrial testing. They have excellent mechanical properties, are extremely hard and wear-resistant, have a low, constant contact resistance

and are only slightly subject to transport phenomena. Table 3 compares some of the physical and mechanical properties of contact materials previously used and the newly-developed ones such as the alloy Au71Ag26Ni3.

a Material	b Měrná hmotnost při 20 °C kg/dm³	c Teplota tavení Solidus °C	d Tvrdost HV_{30} e měkký	f tvrdý	Mez pevnosti g σ při MPa e měkký	f tvrdý	h El. měrný odpor $\varrho \cdot 10^9$ Ω.m
AuNi5	18,3	995	100	190	290	590	138
Au71Ag26Ni3	15,3	1080	95	155	350	570	113

Table 3. Physical and mechanical characteristics of gold contacts

Key:
a. Material
b. Density at 20° C, kg/dm³
c. Melting temperature, solidus, °C
d. Hardness HV_{30}
e. Soft
f. Hard
g. Limiting strength
h. Electrical resistivity

Gold Microwire

Gold microwire is used in integrated circuit packaging to connect the system itself (the chip) to the package leads. Gold is excellently suited to this operation, since it can be joined easily to other metals by thermocompression at temperatures and pressures well below those which would melt them.

Finding ways to save gold in this application involves many problems, economic as well as technical. Basically, there are two ways to conserve gold.

--Decreasing the diameter of the microwire. For example, using 22.5-micron wire instead of 25-micron wire yields a 22.5 percent saving of gold, although it is necessary to make changes in the machine inventory.

--Replacement of gold microwire with a base metal (aluminum). Some problems arise in this replacement; for example, aluminum wire cannot be welded by thermocompression, but only ultrasonically. Other shortcomings are, of course, the short storage time and the high purchase price.

Gold Foil

Foil made of a gold-antimony or gold-silicon alloy is used in microelectronics to solder chips to their packages. This process makes use of gold's notable property of forming an extremely low-melting alloy with silicon.

Conservation of gold involves primarily a decrease in the thickness of the foil used. By beginning the production of foil 15 microns rather than 25 microns thick it would be possible to save about 50 percent on the gold used for this purpose.

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CSO: 2402/38

BRIEFS

VEHICLE EXPORTS TO USSR--Czechoslovak motor vehicle exports to the USSR during the 1981-1985 period will include 21,400 Tatra trucks; 11,250 Avia trucks; 13,000 Orlican refrigerated trailer vans and Skoda tractor-trailers; 500,000 motorcycles, almost 10,000 loaders and over 3,000 tractors for forestry operations. Production of the Tatra-815 heavy trucks is increasing. These trucks are equipped with new 8, 10 and 12-piston air-cooled diesel engines T 3-930 of 170-300 kw output. Tatra T-815 Arktik truck has been produced for service under difficult operational and climatic conditions. It has a heated cargo area, very effective cab heating, auxiliary equipment for starting engine under extremely cold conditions, as well as other features developed during its testing in Siberia. In 1980, talks were held on possible CSSR-USSR cooperation in development of a modern passenger car which would need less materials for its production and have a low fuel consumption. [Prague SVOBODNE SLOVO in Czech 13 May 82 p 3]

CYCLONE REACTOR PRODUCES ANTIMONY--Trial run of the so-called cyclone reactor for production of antimony is currently taking place at the Slovak National Uprising Plant in Vajskove. First of its kind in Europe, the cyclone reactor can process even low grade ore. Yearly production of antimony at the plant is expected to reach 2,000 t, compared with current 1,000 t. [Prague ZEMEDELSKE NOVINY in Czech 7 May 82 p 8]

CSO: 2402/51

DIRECTOR OF COMPUTER APPLICATIONS ENTERPRISE INTERVIEWED

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 pp 2-3

[Interview with Janos Juhasz, director general of the Computer Technology Applications Enterprise, by Dr Ivan Szabo]

[Text] The Computer Technology Applications Enterprise (SZAMALK) came into being on 1 January 1982 on the basis of a position taken by the Science Policy Committee and a resolution of the Central Statistics Office by reorganizing three computer technology organizations (SZAMKI [the Computer Technology Research Institute], OSZV [the National Eomputer Technology Enterprise] and SZAMOK [the Computer Technology Training Center]) into a new, technical development type enterprise.

The purpose of its creation was to concentrate resources and thus aid execution of the Computer Technology Central Development Program (SZKFP), increase the scope of research and development achievements, contribute to the development of computer technology applications, aid the practical realization of R and D results, develop training, operations technology and service forms and increase, by virtue of a more coordinated and swifter development of applications tasks, the economic results which can be attained through use of the tools.

[Opening Statement] Taking into consideration the national requirements and based on the attributes of the three organizations the tasks of the SZAMALK are the following:

1. Creating out of import and domestic computer technology elements those acquisition and marketing systems and configurations which correspond to the applications guiding principles and tasks, providing software for them, operating them, developing technologies which increase the efficiency of applications, maintaining them and providing parts.

2. Computer technology research and development. Creating applications systems of national economic significance by use of modern technologies.

3. Planning the installation of computer systems and installing systems. This activity is carried out on a subcontracting and prime contracting basis.

4. Providing specialist training. Providing special training for products marketed or manufacuured by the enterprise.

5. Providing information, forecasting and observer services.

[Question] What are the chief characteristics of the new enterprise in regard to enterprise type?

[Answer] The enterprise is a developmental enterprise of the complex engineering type. It will concentrate its activities on accelerating the innovation process, optimalizing computer technology development and implementing efficient technical-economic actions; this will be done in an entrepreneurial fashion, undertaking rational risk.

It will prepare for practical utilization of the achievements of research and development. It will do this with a precise definition and harmonization of "daily" and long-range developments.

It can market the results of its activities independently, but increasingly in the form of complex "products."

[Question] The SZAMALK is a base institution of the Central Statistics Office. What will determine the developmental trends of the enterprise and what chief enterprise tasks will be linked thereto?

[Answer] The SZKFP will determine the direction of enterprise developments. In accordance with this the chief task of the enterprise as a many-sided development of computer technology applications, increasing their efficiency. We calculate that the degree of cumputerization and the development of applications in our homeland have already reached the level where we can post as the goal the unfolding of an intensive development based on quality factors, the spread of modern computer technology procedures and methods.

[Question] What are the most important enterprise development goals?

[Answer] To mention only the really most important, they are the following. Increasing the goal-orientation of scientific research and development tasks which can be regarded as new; aiding their application; developing elements which increase efficiency in machine use, in technology and in services; and the spread of systems which can be standardized. Our goal is to increase the economic results which can be attained through applications and to help make economic processes more coordinated.

[Question] What are those chief enterprise activities the development of which, after the merger or vertical integration, will serve as a means for the fulfillment of the tasks of the enterprise?

[Answer] Without going into every detail, I would mention the following chief aspects. The functioning of the enterprise will be characterized by entrepreneurial activity; it will prepare, coordinate and organize entrepreneurial actions. These undertakings will pertain primarily to complex computer

technology applications tasks and systems which can be standardized but will extend to the solution of ad hoc tasks also, including consulting, feasibility studies, research and development on concrete tasks, methods and technologies, as well as teaching and providing a broad range of services--planning, execution, operation, etc.

Actions will be carried out primarily in the form of developmental undertakings. The enterprise will cooperate with all those domestic and foreign organizations which can contribute to the effectiveness of the undertaking..

We plan to realize our entrepreneurial activity at two levels. At the enterprise level, for example, we will market computer systems, parts and auxiliary tools. At the level of the enterprise professional offices we will do those things which are not of a complex character, where the professional offices have all the conditions for successful realization. I am thinking here, for example, of training and service activities.

Basically we will carry out our activities on the basis of orders; but we will do our educational and information work primarily on the basis of a state commission.

[Question] How will research and development on enterprise applications systems change?

[Answer] The integration processes taking place in the people's economy require a better coordination of the R and D-production-marketing chain. To a crucial extent socialist import and domestic production determine the technical level of applications development. SZAMALK must increase the ability of the available tools to meet the tasks. For exmmple, with solutions which increase reliability and adaptability. And further, with complex applications which can be standardized and adapted to various levels, with technical further development, with software development, by decreasing the time needed to introduce a system, etc.

[Question] In what way will the software research and development of the enterprise be linked to the computer investment possibilities of the Sixth Five Year Plan?

[Answer] SZAMALK will handle about half of the computer investment of the Sixth Five Year Plan.

We must regard the supply of software for the ESZR or MSZR machines sold by the enterprise, the development of key systems and the introduction of these systems to be the most important tasks of the enterprise.

As the largest domestic systems enterprise SZAMALK must participate in the development of significant user and model systems which do not have an adequate supply of software. In the interest of an effective performance of this activity we must organize software manufacture, for which we will need a staff of highly qualified experts.

We must analyze the installation, tuning and follow-up costs deriving from the deficiencies of machine acquisition; we must make use of the market mechanism when determining the number and composition of framework systems (DOS/OS, VS, VM, RSZ-11). The framework systems must ensure the modern data base oriented, remote processing operational mode also.

Due to capacity considerations and the significance of results achieved thus far by the several institutions we must develop for this work a proper division of labor with other institutions also.

[Question] How will research and development be linked to the services provided by SZAMALK?

[Answer] The basic requirement is that SZAMALK bring user needs and the possibilities offered by system deliveries into harmony with its own complex developments and services.

We will solve hardware-software development for given systems partly with our own intellectual capacity and partly by bringing in outside institutes, in accordance with the conditions of research and development contracts tied to results.

[Question] How will the enterprise handle instruction; what are the fundamentally new aspects of this basis activity?

[Answer] Computer technology training must be developed further on the basis of the development realized in the past 10 years. Taking into consideration the trends of development we must count on increasing demand for special users and continual further training. As a result of the creation of new computer centers, the movement of experts, the increase in user needs and the expected increase in the mobility of our entire society there is also increasing interest in the training of experts in specialized study courses. But the slower increase in the number of computers will cause a ratio change in the area of expert training.

With the increase in the leadership level of enterprises the computer technology training of leaders is coming into the foreground. Training must keep pace with domestic development and the research and development and service activities of the enterprise so that, acquainting people with the new tools and methods, it can increase the demand for more developed computer technology products and services and increase the receptivity of trained experts.

SZAMALK must develop expert training, product-oriented and machine-oriented training, further training and leader training into a uniform interrelated system. Training will be done partly with independent actions and partly in close cooperation with the developmental and service activities of SZAMALK.

[Question] The openness and objectivity of information are interdependent with incentive, with calling attention to the new. What is the task and goal of information in the new organization? Might not its partiality mean a bias toward a narrower spectrum (the realization of the interests of SZAMALK)?

[Answer] The goal of the information activity of SZAMALK is a double one. On the one hand it must provide information to organizations, experts and users interested in computer technology applications, as a national task; on the other hand it must provide information to the various branches within our enterprise and to the experts working in them, information needed for professional and efficient use of computer technology, realizing selectivity and speed and satisfying the need for concrete news. In accordance with national interests, influencing and forming professional views will determine the central tasks for information. One might also list here those tasks which give an account of the developmental trends of computer technology, with special regard to domestic needs and possibilities, to the entrepreneurial and investment spirit attaching to the use of computer technology and to a positive influence on demand.

Another stressed information task is to call attention to the actions, undertakings and services of the Central Statistics Office and its institutions, and the enterprise itself. The results achieved in the use and development of modern computer supported information technology will be handed on to other institutions. Our research and development achievements will be published in a professional way.

The editing, preparation, publication and distribution of professional books and textbooks, various publications and mathodological and other proposals and guides belong in the sphere of information. Preparing commercial brochures on hardware and software products, editing the professional computer technology journals of the Central Statistics Office (SZAMITASTECHNIKA and INFORMACIO-ELEKTRONIKA), and taking part in the editing of the international collection of computer technology articles (SBORNYIK) belong here also. This activity also includes maintaining a public computer technology library, operating it as "national task professional library," developing and operating a computer supported professional literature information system and providing continual and ad hoc services using our own, domestic and international data bases.

[Question] Will the computer technology technical services change? Will these activities, in the future, be inspired by the obligations and services characteristic of a trade mark service?

[Answer] By virtue of its technical services SZAMALK must help prepare the users to receive computer technology tools. It must support the development and operation of efficient systems. It must carry out those trade mark service tasks which are usually carried out by the manufacturing base in countries manufacturing computers. Within the enterprise these activities will involve giving advice, planning and carrying out computer investments, training, maintenance, ensuring trouble free operation, putting computers into operation, collecting and analysing information and providing feedback to the manufacturing enterprise--in the interest of technical development.

It will also include the coordinating activity needed for commercial policy questions of the enterprise, participation in international testing and work organs, where we must realize the domestic applications and technical service requirements.

We must prepare for the fact that in the coming decade technological development will shift in the direction of the very large and the very small (but very efficient) machines, as part of increased integration. Because of the high degree of integration we must work out and introduce entirely new technologies for maintenance and repair.

[Question] What does the leadership of the enterprise plan in the area of parts supply and materials supply, an area such debated over the years although not yet provided for in a reassuring way? Will it set conditions, will it employ sanctions against those shippers the activity of which might restrict continuous operation? Will there be a change in regard to setting up consignment warehouses for ESZR systems?

[Answer] In the interest of the security and efficiency of operation SZAMALK will ensure a national parts supply for imported computers manufactured within the framework of inter-government computer technology agreements and sold domestically. The acquisition of parts will be harmonized with the acquisition of computers from socialist countries. In the interest of the effectiveness and quality of supply we must pursue the following chief goals: direct parts acquisition from the manufacturing plant must be institutionalized. When signing foreign trade contracts, simultaneous with this or as a condition for signing such a contract, we must sign parts supply contracts. Insofar as possible the precise adherence to contracts and providing the documentation needed to order parts must be the subject of sanctions on shippers. This is a basic condition if we are to be able to place orders in accordance with existing machine inventories. In the area of active electronic elements we must strive to prepare an appropriate replacements list, to make up for shortages and save foreign exchange.

We must also make a gradual attempt to carry out standard tests on parts and to organize renovation at the parts and subassembly level. For both technical and economic reasons we must try to see to it that the enterprises of socialist countries also maintain or establish consignment warehouses.

We must regard a supply of the special materials needed for efficient operation of computers as an organic part of the services offered by SZAMALK. In this regard the enterprise will carry out organizing, acquisition and marketing activity.

[Question] Prior to the vertical integration all three institutes and extensive international contacts. Will this area receive a new aspect within SZAMALK?

[Answer] The contacts, and the further development and strengthening of them, will be fundamentally influenced by the fact that the activity of the enterprise rests on an import base. The existing international contacts will survive, naturally, and a development of them is to be desired. For this reason they have an important place and role in the operations of the enterprise. We consider the acquisition of information, the development of concrete cooperation, support for commercial activities and the cultivation of contacts based on inter-state agreements to be very important tasks. We

especially want to strengthen those which might bring economic achievements for the enterprise and for computer technology applications.

We will continue to cultivate those bilaterally advantageous international contacts which SZAMOK developed and continued in past years with the UN and other international organizations--UNESCO, UNDP and UNIDO. In this way we will be active participants in the institutionalized international exchange of experience which is increasingly indispensable due to the international character of computer technology.

[Question] Might the limited investment possibilities of the Sixth Five Year Plan and other professional considerations mean that in this period SZAMALK will handle the marketing of small computers, complex technical services and software development as stressed tasks?

[Answer] We carried out a circumspect analysis within the enterprise and outside of it. The purpose of this was to survey our resources and define those personnel and objective conditions necessary to carry out the task on the basis of market needs. Our enterprise prescribed the acquisition of a number of special purpose MSZR items. This equipment is intended to aid hardware development, adaptation and training, basic software development in at least two directions (RT 11 and RSX-11/M), user software development, the development of model systems, instruction and services, including the exchange of units during repairs. We consider it very important that, in the interest of realizing our goals, we cooperate with the KFKI [Central Physics Research Institute], because this cooperation could increase our resources and decrease throughput times. It can be seen from all this that we ascribe a very important role to the development of well functioning, well equipped user systems. We can carry out this task only with domestic development and system integration.

Taking into consideration the limited investment possibilities we think that beginning users will be the primary users of these systems, but the purchasers will include those experienced users who want to use the systems for data input and data processing functions.

We are also counting on more complex needs of the so-called big users, such as network control and the computerization of technical, design and process control tasks. Among the tools to be considered I might mention the TPA 1140, TPA/L, TPA/S, TPA 70, TPA 11/EMU, ESZ 1011, VT20 and ESZ 1010M systems of domestic manufacture and the MSZR 3, MSZR 4 and other equipment deriving from socialist import, such as the Elektronika 60 and the MERA 9150 equipment.

[Question] The external contacts of the institutions forming the SZAMALK will not end with the merger. But the earlier contacts of these institutions with each other are being transformed into new internal and more complex contacts. In regard to outsiders SZAMALK will satisfy all those needs previously satisfied by its predecessors. At the same time a number of new possibilities arise, both quantitatively and qualitatively. Taking these aspects into consideration and for the purpose of information and orientation, please describe the enterprise hierarchy and structure, with special regard to the most important organizational units.

[Answer] The director general stands at the head of the enterprise. His work will be aided first of all by the Director's Council, the deputy director general, the Applications Development Council and the organs of the enterprise staff. The deputy director general will oversee the Service and Trade Directorates.*

[Question] In the course of carrying out future tasks, in my opinion, the Trade Office of the SZAMALK--together with the other professional enterprise offices--will have an outstandingly important role in regard to the future of and the profitability of the enterprise. As part of the marketing of new computers this office must formulate needs on the basis of user requirements and break the tasks down into elements for the offices of the SZAMALK. Permit me to formulate my question in the following manner: In such cases, how will SZAMALK "attack" the enterprises or the potential tasks?

[Answer] In regard to a successful execution of the task the role of well prepared market research agents and propagandists is fundamental. No less important is cooperation between the Trade Office and the other professional offices of SZAMALK. We can call this the critical point in regard to the functioning of the enterprise. Actually we must speak of the decentralized nature of the undertaking, which means that we are counting on the appearance of a large number of prime contractors in-house. To return to the agents, let me describe their activity. The agents will work according to economic branch or sub-branch or international relationship. Our Trade Office will work out enterprise trade policy plans for the enterprise; these will be discussed by the enterprise council, made up of the chiefs of the offices, which will transform them into tasks for the professional offices. In a natural way the guiding principles of the national acquisitions policy will influence the enterprise trade policy plans.

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*The Research and Development Directorate embraces three offices.

The offices and their units are the following:

Development Office: with main departments for technical development, small computers, data preparation, remote processing, systems development and programming systems.

Applications Development Office: with main departments for applications program systems, enterprise organization and applications, informatics, applied mathematics and methodology.

Instruction Office: with main departments for organization sciences teaching and computer sciences teaching, a technical and operations main department, as well as an instruction organization and planning department and a teaching techniques studio.

The Service and Trade Directorate includes four offices and one independent main department. The Trade Office has main departments for computer systems, parts and cooperation and marketing. The Technical Services Office has main departments for technical services, preparation of sites, customer service, and technical coordination and supervision. The Information Office has main departments for editorial and publication work and a library and documentation main department. The OSAK [expansion unknown] is an independent main department. The Computer Services Affice embraces a services development main department and computer centers I, II and III.

After the decisions of the council the propagandists will initiate advertising and propaganda actions. The market researchers will study user needs not only in a static way; they will also analyse the effect of their own work and of the advertising and propaganda and evaluate the satisfaction of the users, the success of the business, from professional and trade viewpoints. So the links between the Trade Office and the other professional offices of SZAMALK will create an almost organic net. Intricate multilateral internal contacts will develop between the offices. An enterprise council made up of office leaders will coordinate these contacts and it will designate the prime contractors within the enterprise. Naturally this means that at any one time a number of prime contractor is a guarantee that the user needs incorporated in the contract will be met in a coordinated way.

Naturally, carrying out these tasks requires the creation of a very well qualified staff of sufficient size. We need people of the manager type who are very well acquainted with and can use in a complex way the procedures of commercial, economic, computer technology, building utilities and state administrative organs.

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HUNGARIAN PLANS, NEED FOR COMPUTERS HIGHLIGHTED

Budapest NEPSZABADSAG in Hungarian 10 Apr 82 p 11

[Article by Zsuzsa Szentgyorgyi: "Do We Need Computer Technology?"]

[Excerpts] Our present computer capacity has significant shortcomings. On one hand, it is suitable only for the performance of computational tasks already considered conventional, and we have very few tools suitable for the performance of tasks in computer graphics and text processing, which are becoming widespread in highly industrialized countries. (Such tasks arise in industrial process control and office automation.)

There is a poor selection of graphics and text-processing tools on the domestic and socialist market, in spite of the fact that the selection of precisely these tools has greatly increased in the world in the past few years.

As another disadvantage, computer tools are not directly accessible. Many technical experts are reluctant--let us admit with good reasons--to turn in a program package for the solution of a problem to a more or less closed computer center from where it will be returned with error messages after a few days; but even if they are lucky and there are no errors, it may take a day or two to run the program.

Thus it is no accident that in the last decade remote data processing became the most important and fastest-growing area of computer technology. If the user can directly access the computer via some type of remote device--terminal--then he (she) has the opportunity immediately to modify, correct and change his (her) program and directly access the results. The situation is somewhat analogous to sending a telegram by walking to the post office several streets away from our home (which may or may not be open and may or may not accept the telegram) and being able to send it via our home phone. The comparison is good as far as the telephone is concerned. Unfortunately, one of the significant hindrances encountered in the development of computer terminal systems and nets in our country is the absence of telephone nets. (According to international statistical data of 1 January 1979, the present telephone density in our country is 5.2 exchanges per 100 people, while countries similar in size and economical conditions show the following values: Austria 28, Greece 22.7, Czechoslovakia 10.6, Bulgaria 8, GDR 7.9, Romania 6).

However, it must be added that at the present our computer centers could not even serve users in the conversational mode.

Even with these hindrances, there is an extraordinary need for computer technology in our country. In the current 5-year plan, within the framework of the central computer development program, the branch and central managerial organizations proposed 30 large companies (distinguished in the production of national wealth and export to capitalist countries) for the introduction of integrated computer systems that cover their entire production and economy. In the case of production enterprises "to be integrated" is also connected to the automation of technological processes. It would take up too much time to name all of them; so we shall mention only a few: the National Oil and Natural Gas Industry Trust, the Hungarian Electrical Works Trust, the Taurus Rubber Industry Company, Videoton, the United Incandescent Light Works, the Paper Industry Company; the Hungarian State Railways (MAV), the post, the National Savings Bank (OTP); the Budapest Meat Industry Company; Chemolimpex, Mogurt, Terimpex; a reservation system including five hotels and tourist offices.

It would be difficult to classify all those applications in which the use of computer technology is already indispensable; i.e in which in developed countries--in spite of the economic recession, or perhaps as a way to overcome it--computer tools and methods are used in increasing quantities. It is possible only to highlight a few, since today there is no branch of the economy or social managerial organization in which the use of computers is not possible and not required.

One of the most important ones is computer-based design and production, ensuring the competitiveness and quick appearance of new products. Today, in many cases, this is accomplished in a unified system. In our country, there are some initiatives at the research-and-development and experimental-use level.

In computerized design, we can talk about several years of domestic experience. In the recent past, during the organized meeting of the National Technical Development Committee and the Hungarian Academy of Sciences, national experts gave account of the present achievements and were surprised how multifaceted and widespread the application of computer tools is in the designing of electronic, electrical, mechanical devices and systems and construction industry installations. The role of computerized design is especially important, one could say--without exaggeration--vital in the currently initiated microelectronic device and component manufacturing program.

Administration and bookkeeping are the most difficult part of management and require the most amount of labor. In the past 2 years, there has been a tremendous selection offered for the mechanization and automation of bookkeeping. These are often composed of modules which can be configured rather inexpensively or expanded in stages. The only trouble is that failures and delays in the application are usually caused--not only in our country--by the organization and computer adaptation of bookkeeping.

Computer technology is conventionally used for the controlling of technological processes. New possibilities are offered by relatively inexpensive and small microprocessor systems, which require minimum supervision and personnel; these can be used partly for the substitution of the earlier individual controllers, and partly with an expansion of computer tasks, and--in the appropriate configuration--as independent controller systems.

Integrated communications systems, recently referred to as teleinformatics, combine the advantages of computer technology methods and those of communications. Via the system including a TV set and an adapter, large central data bases and information files can be quickly accessed at the workplace or even at home. Today, such systems are available only in the experimental operating mode in most countries, e.g. the English Teletex and Viewdata, the French Antiope, or their Canadian and West-German equivalents. Experiments have already been initiated also in Hungary with the cooperation of Orion and the Budapest Technical University, and regular service is expected by the end of the decade.

To support, develop and popularize the above-mentioned trends and tendencies, the central computer development program is making a significant effort. Since, as mentioned, the development of microelectronics, computer technology, telecommunications and automation today can no longer be separated, the central computer development program is joining the central electronic development program (initiated by a government resolution at the end of last year) in several areas (e.g. in the area of computer-assisted technical planning, or--at the other end--with the electronic device base to be developed in our country.

Projects supporting research and development are the essential and progressive parts of central development programs. For instance, the national program aiding computer applications provides central guidance, financial support in the most diverse areas (agricultural and food industry systems, council bookkeeping, education, electronic design, etc.) to facilitate the mass use of these methods and model systems. The National Technical Development Council, the Ministry of Industry and the Hungarian Academy of Sciences are promoting with common research and development programs the national production and spreading of microprocessor systems and controls and the application of computer tools and methods in the automation of production processes.

As we can see, computer technology has already grown strong roots in Hungary and become an indispensable tool, and we can rightly say that there is a real need for it. What is most important: a receptive culture has been created, without which it would be a waste of money to buy and install any further tools. This culture involves more than just the 20,000 full-time computer experts; it also includes those people with other professions--doctors, architects, mechanical engineers, economists, sociologists, to mention only a few--who use computers in their day-to-day work. This developmental trend has extraordinary sociological correlations in education, professional training and the planning of the work force structure.

Do we need computer technology? Today this is no longer a question, because without it we cannot keep pace with the development of the world. The real question to be answered every day in the 1980's involves more than just asking: "What do we need computers for?," because it is easy to make up request lists, but to answer how we can use computer technology most effectively for the development of our society and economy, taking into account our financial potentials and possibilities.

9901
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NEW BULGARIAN COMPUTER DEVELOPMENTS

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 3

[Article by Georgi Nikolov: "New Developmental Trends in Bulgarian Computers"]

[Text] The active participation of Bulgaria in computer technology development and manufacture within the framework of the ESZR [Uniform Computer Technology System] made possible series manufacture of the already well known medium capacity computer models ESZ 1020, ESZ 1022 and ESZ 1035. In the course of creating these computer models research was done in the area of expanding functional possibilities and achieving a better performance/price ratio.

In the newest ESZ 1035 model (delivery began in the recent past) they introduced qualitatively new solutions along with increased performance--160,000 operations per second. The new solutions include organization of virtual memory, a reloadable control memory and automatic error correction in storage. New technical devices can be used also: a picture screen operator's console, operational storage based on integrated circuits, 200 M byte disc background storage and magnetic tape storage with a writing density of 1,600 bits per inch.

In our judgment if one is to greatly increase user efficiency it is not enough only to increase capacity. Research has shown that the best way to increase efficiency may be to use special technical and programming tools. These tools are developed to solve concrete tasks but they can be used widely.

In general these developments require the arithmetic processing of large volumes of information, so they developed and are manufacturing the ESZ 2335 special matrix processor. This equipment significantly increases performances (in the case of addition, multiplication and division) and it has a speed of 10 million operations per second. The matrix processor can be connected through a special adapter unit to the central unit of an ECZ 1035 computer. For certain types of tasks this can increase the performance of the computer 35 times. On the basis of the matrix processor and the ESZ 1035 computer they worked out a special computer technology system for the processing of seismographic information. This can be used especially in the course of geological research and petroleum and natural gas prospecting. This task was solved in Bulgaria for the first time in the socialist countries.

The other chief trend for increasing efficiency is to accelerate the writing, systematising and retrieval of large volumes of information. For this purpose they devised a subsystem which, thanks to its technical solutions, makes it possible to write incoming information at a speed of a maximum of 6.5 M bytes per second onto magnetic disc storage with a capacity of 100 or 200 M bytes. The subsystem can be connected via a standard ESZR adapting unit to the block multiplex channel of any ESZR computer. This is the first step toward the creation of high efficiency data base control systems. It can be used in many areas where large volumes of information must be written quickly and retrieved in an associative way. If we connect the system described above to the previously mentioned matrix processor then we can create an efficient mathematical information processing system.

The ESZ 1035 computer--which, on the basis of its capacity, we can list in the medium capacity computer category--can be developed into a system which is competitive with the large capacity computers of the ESZR, and this can be done without significant material expenditures.

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NEW TASKS IN COMPUTER APPLICATIONS

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 1

[Article by Lajos Pesti, vice-president of the Central Statistics Office: "Our Tasks in the New Phase of Computer Technology Applications]

[Text] These days in our homeland also the application of computer technology has entered a new phase. The requirements of this new phase are set down by the April 1981 resolution of the Council of Ministers, which approved the detailed guiding principles of the Computer Technology Central Development Program pertaining to the Sixth Five Year Plan, and by the November 1981 resolution of the State Plan Committee, whereby the concrete action program developed on the basis of the guidelines was adopted.

These resolutions require substantial substantive changes in the application of computer technology, because the change in the social-economic environment has an essential influence on the applications possibilities of computer technology. But also because enough domestic experience has collected already in a number of areas of new applications technology--such as data base management, structured program design, interactive program development, remote processing, etc.--that their broad utilization has become realistically possible or timely.

All this makes it necessary for us to review our tasks and reevaluate our methods on the basis of the state resolutions. If I wanted to characterize applications work thus far, in a summary and greatly simplified way, I would have to say that thus far we have followed an essentially extensive developmental policy--due to the relatively late beginning of a broad application of computer technology. In general we have set "quantitative" goals--increase the number of computers, exchange the existing ones for larger ones, increase the personnel of professional institutions, create large professional organizations and so forth.

Already today and in the future our developmental policy must be directed at making applications more intensive. It must be recognized--and this is reflected in the new five-year Computer Technology Central Development Program which has been approved--that the central resources for computer technology, the investment and foreign exchange frameworks, cannot be increased, rather they will moderate, so we must choose not the simpler but more expensive

methods, rather we must choose the more complex, more demanding but more efficient and more economical methods.

Fortunately such methods are at our disposal. In regard to hardware developments it is possible to expand or exchange domestically developed storage--instead of exchanging computers in order to increase capacity. (More extensive information on this can be found in this issue.) Storage expansion--where it can be used rationally--will open the possibility of converting to higher level operating systems and making use of interactive or multiprogramming techniques.

Along side the larger computers (and increasingly as a rational replacement for them) the use of "more but smaller machines" has come on the agenda. Naturally the advantage of more smaller machines can be exploited within a single system only if it is possible to realize a physical link at a certain level between the machines. There is domestic experience in realizing machine-machine or channel-channel links--if, unfortunately, not much for the time being.

Organizing computers belonging to different systems into a network represents another intensive resource. Those computer centers charged with building up their networks may have been surprised to learn that the Hungarian Posts is already capable of providing X.21 level line-connected network service.

So the time has come to put on the agenda the development of a national model for remote processing networks so that the network elements or units should be built up according to some rational ordering principle, instead of having many small, autonomous networks. Such a model would represent a "reference point" for domestic manufacturers in regard to adaptors, controls, etc.

The technical conditions indicated above will make possible the use of more developed software technologies. A broad variety of remote processing methods is needed to develop "tele-informatics." The requirements of a given application must determine whether use of a TSO or a TP monitor or the creation of an RJE, CRJE or interactive man-machine link is most efficient. But the conditions necessary for this must be available system by system, and in this event we must encourage the introduction of more developed procedures, instead of "conservative" applications methods, always keeping in mind user efficiency and economicalness.

It appears that with the gratifying spread of the IDMS program system data base management is finally entering mot only as a theme for domestic conferences but also the everyday instrumentarium of users. So we must adjust our system design and organization methods to this new possibility. The same thing applies to program development methods also because structured program design, automatic program documentation, etc. are still the favored area of researchers rather than the daily applications practice of computer centers.

At present the organization of a few chief authorities, trusts and large enterprises is undergoing modification or development. Organization development has become timely in the area of computer technology applications also. Such

developmental aspirations must serve the intensification of applications also. Recently there has been a gratifying reduction in the organizational isolation among the several economic branches, and this trend must be strengthened. Export and service bases oriented toward applications functions must be developed in the branch organization-development institutions. At present they are dealing with each applications theme in virtually every organization-development institution but one can hardly find any unique specialization in these institutions, outside of the branch profile.

As we can see, the new phase of computer technology application represents a "challenge" for our applications experts, in regard to how they can do more efficient work and achieve more and better results with less expenditure. This also requires from the domestic development and manufacturing institutions that they give priority to those developmental themes, those design and technological developments, which will facilitate adaptation to the new phase. Finally, this also gives a greater and more complicated task to those directing applications, because it requires a higher level applications development policy, a more efficient incentive system in the right direction and the making of decisions in a more complex environment.

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RESULTS OF USING DOMESTIC COAL FOR COKING

Budapest KOHASZAT in Hungarian Vol 114 No 12, 1981 pp 513-517

[Article by Pal Gonczy, graduate metallurgical engineer, Danubian Ferrous Metallurgical Works: "Evaluation of the Trial Use of Metallurgical Coke Made From 100 Percent Komlo and Pecs Coal in Metallurgical Operations"]

[Text] Since domestic manufacture of metallurgical coke has started, only a relatively small percentage of domestic coal was used to make the coking-coal blends. Trial coking was carried out at Danubian Ferrous Metallurgical Works from 100 percent domestic coals. This article describes the experimental manufacture of pig iron with such coke.

A large-scale trial for the use of metallurgical coke made from a mixture of cokable domestic coals was carried out in the two blast furnaces of the Danubian Ferrous Metallurgical Works between 26 and 31 March 1981.

The trial was especially interesting since the coke had to be made at the same time as the metallurgical processes took place, so that the characteristics of the metallurgical coke were not known. Also, it was necessary to ensure that the blast furnaces continue to produce normally during the trial since the steel mill had to be continuously supplied. Last but not least, in spite of the major change in the coal mixture to be coked -- and thus also in the metallurgical coke -- a significant period of one week had to be successfully operated. The true significance of the trial is that we have used at the Danubian Ferrous Metallurgical Works such coke for the first time, and that we have produced coke made from 100 percent domestic coals for the first time since a long time. It is a generally known fact that domestic coals (from Komlo, washed at the Works (DV), and from Pecs) accounted for only about 50 percent in the coal mixture used to make the coke before.

It should also be mentioned that the reference period selected was 1-25 March 1981 -- the period preceding the test period (26-31 March 1981). Only then could we make reasonably sure that the ore batch in the blast furnaces was uniform and comparable (for example in terms of sinter and high-iron concentrate in the specific batch).

The Ore Batch in the Blast Furnaces

Comparison of the metallurgical operations in the reference period and in the test period, and the determination of the changes caused by switching from one coke to another is facilitated if the specific ore batches and the specific concentration of the major ingredients in the ore batches are about the same. For this reason we attempted to ensure that no major changes take place as we went from the reference period to the test period. It was therefore necessary to examine the ore batch. The ore batch is not the same as the ore mixture; the former also includes the coke, and the switch from one coke to another affects the amount of slag-forming material and thus also the specific batch. Table 1 shows the amounts of materials used during the reference period and during the test period. Table 2 shows that one ton of pig iron was produced from 1,967.5 kg ore batch during the reference period and from 1,966.4 kg ore batch during the test period. The difference was very small, 1.1 kg per ton of pig iron. The reason for this was that (1) the ratio of the sinter and Indian ore on the one hand, and the Swedish ore on the other hand — which accounted for the major portion of the ore batch -- was close over the period (see Lines 1-3 in Table 2) and (2) there were no significant differences in the chemical composition of the sinter -- made at the Danubian Ferrour Metallurgical Works -- during the two periods.

Quality of the Metallurgical Coke

The properties of the metallurgical coke are determined by the basic properties of the coals coked, the technological equipment, and the manufacturing technology. In the course of the test, the only change between the reference period and the test period was that the coal mixtures used to make the coke were different. The specifics of this difference are shown in Table 3; the individual coals used differed in composition and other characteristics.

Table 1. Material consumption, production, and time data of blast furnaces

Item	Designation	1-25 March 1981 (reference period	26-31 March 1981 (test period
1.	DV sinter, tons	81,880	21,080
2.	BEM sinter, tons	18,968	1,846
3.	Indian ore (116), tons	20.518	4,317
4.	Swedish ore, tons	2,127	742
5.	Iron chips, tons	1,949	66
6.	Oxidic manganese ore from Urkut, tons	457	57
7.	Martin slag, tons	3,914	1,169
8.	Solder slag, tons	90	-
9.	Ore mixture (with fly dust), tons	129,903	29,277
10.	Ore mixture (without fly dust), tons	126,570	28,525
11.	Limestone, tons	2,396	1,526
12.	Bulk dolimite, tons	3,206	1,837
13.	Mixture (with fly dust), tons	135,505	32,470
14.	Fly dust, tons	3,333	752
15.	Mixture (without fly dust), tons	132.172	31,718
16.	Metallurgical coke, tons	41,426	9,905
17.	Residual oil, tons	4,006	972
18.	Pig-iron production, tons	66,023	14,889
19.	Downtime, days	0.743/ 0.837	0.090/ 0.117
20.	Operating time, days	24.257/ 24.163	5.910/ 5.823
21	Calendar days, days	25/25	6/6

Note:
The data under items 19 to 21 refer to Blast Furnace I/Blast Furnace II

Table 2. Specific material consumption data

Item	Designation	1-25 March 1981 (reference period)	26-31 March 1981 (test period
1.	Sinter, kg per ton of pig iron	1,527.5	1,539.8
2.	Indian and Swedish ore, kg per ton of pig iron	343.0	339.8
3.	1 + 2	1,870.5	1,879.6
4.	Specific ore mixture, kg per ton of pig iron	1,967.5	1,966.4

Table 3. Amount of coked coal mixture in percent

Item	Designation	1-25 March 1981 (reference period)	26-31 March 1981 (test period
1.	Washed DV coal (from Komplo)	20	80
2.	From Pecs	14	20
3.	Soviet coal	24	-
4.	Doubrava coal (from Czechoslovakia)	28	-
5.	Jeremenko coal (from Czechoslovakia)	6	-
6.	Sichta coal (from USSR)	8	-
7.	Total:	100	100

Table 4. Values -- mean values -- of blast-furnace coke

Item	Designation	1-25 March 1981 (reference period)	26-31 March 1981 (test period)
1.	Moisture, percent	3.36	4.05
2.	Ash content, percent (n)	12.30	13.40
3.	Sulfur content, percent (n)	1.39	2.10
4.	Drum strength (M_{40}), percent	78.87	81.95
5.	Friability (M_{10}), percent	6.20	5.49
6.	+60 mm grain size category, percent	26.89	24.02
7.	Calorific value, kJ/kg	27,749.2	27,299.1

Tables 4 and 5 show the typical characteristics (average values and scatter) of the blast-furnace coke made from the mixtures described in Table 3 during the reference and test periods. It can be seen that the metallurgical coke made from a mixture of 80 percent washed Komlo coal and 20 percent Pecs coal differed from the coke used during the reference period in the following terms:

- The moisture content increased and became less uniform as time went on. This change may be attributable to a change in coke porosity.

- The ash concentration increased by 1.1 percent, from 12.3 percent to 13.4 percent. The reason for this change is obvious: the coal mixture used to make the coke had more ash. The increase was as could be expected. The data presented in Line 2 of Table 5 indicate that the ash content was more uniform during the test period. The change also indicates that the composition of the non-domestic ingredients of the coal mixture was probably less uniform, so that a decrease in the concentration of these ingredients improved the uniformity of the batch.

- The sulfur content increased by 0.71 percent, from 1.39 percent to 2.10 percent. In this case too, the reason for the change is obvious: the domestic coals contain more sulfur than the imported coals. The uniformity of the sulfur concentration was the same during the reference period and the test period.

- The drum strength increased from 78.87 percent to 81.95 percent. There was a strength increase. The scatter of the drum strength increased, but not to a significant degree.

- The friability improved; it decreased from 6.20 percent to 5.49 percent. A decrease in crumbling indicates better physical properties; the scatter of friability increased, but not to a significant degree.

- There was some decrease in the concentration of the fraction with more than 60 mm particle size, from 26.89 percent to 24.02 percent. The change indicates a shift toward smaller grain sizes. The values showed greater scatter; the scatter increased from $\pm$1.88 percent to $\pm$3.94 percent.

- The calorific value decreased in line with the increased ash and moisture change of the coke. The decrease was from 27,749 kJ/kg to 27,299 kJ/kg.

Table 5. Values -- scatters (±) -- of blast-furnace coke

Item	Designation	1-25 March 1981 (reference period)	26-31 March 1981 (test period)
1.	Moisture, percent	0.32	1.06
2.	Ash content, percent (n)	0.43	0.17
3.	Sulfur content, percent (n)	0.05	0.05
4.	Drum strength (M_{40}), percent	1.24	1.35
5.	Friability (M_{10}), percent	0.36	0.49
6.	+60 mm size category of grain, percent	1.88	3.94

Table 6. Pig-iron and slag composition (mean values)

Item	Designation	1-25 March 1981 (reference period)	26-31 March 1981 (test period)
	Pig iron		
	- Si content, percent	0.92	0.90
	- Mn content, percent	0.55	0.52
	- S content, percent	0.048	0.038
	- P content, percent	0.104	0.11
	Slag		
	- CaO content, percent	40.43	42.08
	- MgO content, percent	9.90	10.36
	- SiO_2 content, percent	38.68	37.05
	- Al_2O_3 content, percent	11.37	11.06
	- S content, percent	1.99	2.44
	$CaO:SiO_2$	1.045	1.136
	$(CaO + MgO):(SiO_2 + Al_2O_3)$	1.006	1.090

Henceforth, the blast-furnace coke will be treated as an entity; its effect will not be examined in individual sections. The reference made earlier to a change in coke quality already reflects this approach.

Composition of the Pig Iron and the Slag

Table 6 shows the average composition of the pig iron and tapped slag during the reference period and the test period. It can be seen clearly from the data presented in Table 6 that the quality of the pig iron was higher during the test period than during the reference period, as illustrated by the decrease in the sulfur content, in spite of the fact that the coke contained more sulfur (Line 3 in Table 3). The reason for this was that we increased the $CaO:SiO_2$ and the $(CaO + MgO):(SiO_2 + Al_2O_3)$ basicities of the slag, so that the sulfur content of the slag increased and that of the pig iron decreased. There were no significant differences in the silicon, manganese, and phosphorus content of the pig iron.

In view of the fact that the sulfur content of the pig iron was lower than during the reference period, we can also state that we have increased the basicity of the slag more than was necessary. Although the need for doing this is evident in a test, we must be objective and declare that this increased the consumption of materials and of coke specifically. If we disregard the amount of sulfur escaping with the fly dust and furnace gases, we find that the expression $So = (S)=[S]$ applies, so that $\Delta So = \{(S) + [S]\}$. During the test, the increase in the sulfur content of the system was due fully to the increase in the sulfur content of the coke; thus, the equations $\Delta S(k) = \Delta So$ and $\Delta S(k) = \Delta\{(S) + [S]\}$ applied. The data presented in Table 7 confirm this. Had we taken pig iron containing 0.048 percent sulfur -- and not one containing 0.038 percent — in the test period, which would have been the amount to use with the test conditions being stable as they were, the $(CaO + MgO):(SiO_2 + Al_2O_3)$ basicity would have been 0.03 lower and the consumption of 20 kg per ton of additives for pig iron would have been reduced.

Technological Parameters

Table 8 shows the major technological parameters for the reference period and the test period. We have already established the ore batch during the two periods and the different coke qualities used in them.

Obviously, in our test the change is the use of another coke. Based on what we know, we can already state that there was no functional relationship between the ore yield, the temperature of the blast air, and the moisture content of the blast air on the one hand, and the quality of the coke used on the other hand. However, these factors influenced coke consumption. Basically the same thing can be said about the specific gravity of the fly dust, of which the values were the same during the two periods. But there were differences in most of the parameters, and there were direct or indirect relationships among them.

Production of pig iron decreased from the level of the reference period by 6.9 percent.

This is evident from the data pertianing to the blast furnaces per day of operation (Line 1 in Table 8). In view of the fact that the intensity of coke burning decreased only by 1.3 percent (can be calculated from the data presented in Line 9 of Table 8) and the amount of mixture throughput decreased only by 0.9 percent (can be calculated from the data presented in Line 10 of Table 8), we can clearly conclude that the decrease in pig-iron output was the result of the deterioration of the batch yield (see Line 3 in Table 8), which in turn is attributable to a major increase in the specific additive consumption and to an increase in additive use since the difference between the batch (not counting the fly dust) and the additive-use change is only 1.3 kg per ton of pig iron.

As mentioned earlier, the chemical composition of the sinter was essentially constant, albeit it was less basic during the test period than during the reference period. However, it was calculated that the specific additive use increased by 6 kg per ton of pig iron even because of this minor difference. It was also mentioned in the discussion of slag composition that for reasons of safety we used higher slag basicity than was really necessary, so that — as mentioned — the amount of limestone used per ton of raw material increased by 20 kg per ton of pig iron.

This small decrease in batch yield was caused by a 0.31 percent decrease in the Fe content of the sinter. The reduction in pig-iron yield must be corrected (it is due to the increase in additive consumption for the 6 + 20 = 26 kg per ton of pig iron increase, and the 0.31 percent decrease in the Fe content of the sinter). The corrected decrease in pig-iron production now reflects the result of all factors resulting from the change in coke:

Table 7.

Item		1-25 March 1981 (reference period)	26-31 March 1981 (test period)	Change
1.	Sulfur content of coke, kg per ton of pig iron	8.72	13.97	+ 5.25
2.	Sulfur content of pig iron, kg per ton of pig iron	0.48	0.38	- 0.10
3.	Sulfur content of slag, kg per ton of pig iron	12.14	17.88	+ 5.36
4.	2 + 3	12.62	17.88	+ 5.26
5.	(S):[S]	26.29	46.05	+ 19.76

Table 9. Composition of the blast-furnace gas (mean values)

Item	1-25 March 1981 (reference period)	26-31 March 1981 (test period)
CO_2 content, percent	14.63	14.89
CO content, percent	25.06	25.00
H_2 content, percent	4.30	4.09
N_2 content, percent	56.01	56.02
$CO_2/(CO_2 + CO)$	0.369	0.373
Calorific value, kJ per m^3	3,623.0	3,589.5

Table 8. Technological parameters (for both blast furnaces)

Item	Designation	1-25 March 1981 (reference period)	26-31 March 1981 (test period)
1.	Pig-iron production, tons per day of operation	1268.6/1458.9	1174.2/1365.2
2.	Ore yield, percent		
	with fly dust	50.82	50.86
	without fly dust	52.16	52.20
3.	Mixture yield, percent		
	with fly dust	48.72	45.85
	without fly dust	49.95	46.94
4.	Blast-air temperature, °C	969	986
5.	Blast-air moisture, g/m^3	17.3	17.6
6.	Residual-oil consumption, kg per ton of pig iron	60.7	65.3
7.	Coke consumption, kg per ton of pig iron	627.4	665.3
8.	Coke firing, tons per day of operation	784.2/927.1	769.6/919.9
9.	Process intensity, tons per m^3 per day of operation	0.896	0.884
10.	Mixture throughput, tons per m^3 per day of operation		
	with fly dust	2.930	2.899
	without fly dust	2.858	2.831
11.	Coke loading, tons per ton		
	with fly dust	3.271	3.278
	without fly dust	3.191	3.202
12.	Specific fly dust, kg per ton of pig iron	50.5	50.5
13.	Specific additive, kg per ton of pig iron	84.8	214.5
15.	Specific charge (without fly dust) kg per ton of pig iron	2001.9	2130.3

Note:
The data in Lines 1 and 8 refer to Blast Furnace I/Blast Furnace II.

$$6.9 - \{[2130.3:(2130.3-26)]-1\}.100 -$$
$$- (21\ 080 \cdot 0.31:14\ 889 \cdot 94) \cdot 100 = 5.2\%$$

where

2 130.3	denotes	the weight of the specific charge without fly dust during the test period, kg per ton of pig iron,
21 080	denotes	the amount of sinter used during the test period, tons,
14 889	denotes	the weight of pig iron produced during the test period, tons, and
94	denotes	the Fe content of the pig iron, percent.

The specific coke consumption is the most important among the technological parameters; thus we had to examine it, the more so since we used 37.9 kg more metallurgical coke during the test period for producing a ton of pig iron. We must know the extent to which its change is justified by the change of coke. In order to obtain a true picture, we must examine the factors which affect the specific coke consumption (other than the known parameters of the metallurgical coke), and we also must know the factors which affected the change in specific coke consumption from the reference period to the test period (other than the known parameters of the metallurgical coke).

In principle, we may state clearly that the specific coke consumption increases with decreasing ore yield and blast air temperature, and decreases when these parameters increase; it increases (decreases) with an increase (decrease) with increasing (decreasing) vlast-air moisture content, Si, Mn, and P content in the pig iron, and the specific additive consumption. The change in coke consumption resulting from the change in coke quality [$\Delta k(k)$] can be corrected at an adequate degree of accuracy with the aid of the expression below:

$$\Delta k(k) = k(v) - k(b) - 10^{-2} \cdot k(b) \cdot \{-1{,}5\Delta t -$$
$$- 0{,}022\Delta V(f) + 12\Delta[\mathrm{Si}] + 3{,}5\Delta[\mathrm{Mn}] + 15\Delta[\mathrm{P}]\} +$$
$$+ 1{,}2\Delta 01 - 0{,}3\Delta \mathrm{M}_1 - 0{,}2\Delta \mathrm{M}_2$$

In this expression

$\Delta k(k)$	denotes	$f\{\Delta n(k), S(k), \Delta h(k), \Delta M_{40}, \Delta M_{10}\}$
$k(v)$	denotes	the specific coke consumption during the test period, kg per ton of pig iron

k(b)	denotes	the specific coke consumption during the reference period, kg per ton of pig iron
Δe	denotes	the change in ore yield, percent
Δt(f)	denotes	the change in the blast-air temperature, °C
Δ[Si]	denotes	the change in the Si content of the pig iron, percent
Δ[Mn]	denotes	the change in the Mn content of the pig iron, percent
Δ[P]	denptes	the change in the P content of the pig iron, percent
Δol	denotes	the change in the amount of injected oil, kg per ton of pig iron
ΔM_1	denotes	the change in additive consumption resulting from the higher than necessary basicity of the slag, kg per ton of pig iron
ΔM_2	denotes	the change in the additive consumption resulting from the higher than necessary basicity of the sinter, kg per ton of pig iron
Δn(k)	denotes	the change in the moisture content of the coke, percent
ΔS(k)	denotes	the change in the sulfur content of the coke, percent
Δh(k)	denotes	the change in the ash content of the coke, percent
ΔM_{40}	denotes	the change in the drum strength of the coke, percent
ΔM_{10}	denotes	the change in the friability of the coke, percent.

After making the substitution with the appropriate data, we obtain the following expression:

$$\Delta k(k) = 665{,}3 - 627{,}4 - 10^{-2} \cdot 627{,}4 \cdot \{-1{,}5 \cdot \times$$
$$\times(+0{,}04) - 0{,}022 \cdot (+17) + 12 \cdot (-0{,}02) +$$
$$+3{,}5(-0{,}03) + 15 \cdot (+0{,}006)\} + 1{,}2 \cdot (+4{,}6) -$$
$$-0{,}3 \cdot (+20) - 0{,}2(+6)$$
$$\Delta k(k) = 40{,}5 \text{ kg/t pig iron}$$

Accordingly, the value of $\Delta k(k) = f\{\Delta n(k), \Delta S(k), \Delta h(k), \Delta M40, \Delta M_{10}\}$ will be 40.5 kg per ton of pig iron, compared to 37.9 kg per ton if we relate to the state defined by the data of the reference period.

In our judgment, the change of $\Delta k(k)$ = 40.5 kg per ton of pig iron is very favorable and realistic if we consider the fact that as a result of the 0.69 percent increase in moisture content, 1.1 percent increase in ash content, 0.71 percent increase in sulfur content, and increases in the coke-ash and coke-sulfur content the additive consumption increased by [214.5 - 84.5 - 20 - 6 = 103.7 kg per ton of pig iron]. This result is also responsible for the fact that the yield of reducing-gas utilization did not deteriorate. This latter fact is confirmed by the changes in the $CO_2:(CO_2 + CO)$ ratio.

To sum up, we may state that the metallurgical operation carried out with metallurgical coke made from 80 percent washed Komlo coal and 20 percent Pecs coal was a unique success. This test answered the question whether the domestic cokable coal resources are suitable for the production of metallurgical coke of the proper quality. The production decrease of 5.2 percent and the 40.5 kg per ton additive consumption increase per ton of pig iron are very satisfactory results. Evidently, the metallurgical process proceeded properly, and there was practically no change in the intensity of the blast furnace, which remained essentially constant.

To conclude, we may state that the decrease in production and the increase in coke consumption during the test period -- basically undesirable effects -- could be decreased substantially (and raise our hopes for the future) by

- realizing dry coking in the new coking plant to be built;
-reducing the higher sulfur content of the coal mixture to be coked by admixture of low-sulfur, weakly coking coal;
-obtaining increased sintering capacity -- which will be the case with the new sintering plant -- to permit us to increase the basicity of the sinter and thereby to correspondingly reduce the additive consumption of the blast furnaces; and
-reducing the additive consumption by acidifying the slag and removing the increased sulfur content of the pig iron by external desulfurization.

2542
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UDC: 662.74.DV

COKE PRODUCTION TO EXPAND AT DANUBIAN FERROUS METALLURGICAL WORKS

Budapest KOHASZAT in Hungarian Vol 114 No 12, 1981 pp 517-520

[Article by Andras Pinter, graduate metallurgical engineer, and Geza Balazsovics, graduate mechanical engineer, KOGEPTERV [Metallurgical Equipment Designing Enterprise]

[Text] Expansion of domestic coke manufacture is necessary because of the condition of the domestic energy supply and the difficulties experienced with the coke supply. Within the framework of the development program, a new, modern coking block, with a capacity of 1000 kt per year, will be built at the Danubian Ferrous Metallurgical Works. In addition, the coal-preprocessing, gas-purifying, and auxiliary facilities will also be enlarged or modernized.

The coking plant at the Danubian Ferrous Metallurgical Works is the major domestic coke-manufacturing base. The coking plant at Obuda Gas Works presently also produces; however, the production there drops continuously, and the plant is scheduled for shutdown in 1986.

Two coking blocks are operating at the Danubian Ferrous Metallurgical Works. The first was started up in 1956, and the second in 1960. They were built according to Soviet designs, and each consists of 55 chambers having a volume of 20 cubic meters.

The coke-manufacturing units are supplemented by the other required production facilities, such as the coal-receiving and -storing facilities, the unit for enrichment of the coal from Komlo, the system for making up and preprocessing the coal mixture, the unit for classifying the wet coke, the gas purification system, the byproduct-recovery facility, and the other processing systems. The coking plant also has the required supply and distribution systems and facilities.

A large part of the coke produced is used in the manufacture of pig iron. The coke with too small grain size, which is unsuitable for this purpose, is used by the general public and the fine fraction is added to the ore-preprocessing mixture.

The lifetime of a coking block is, according to international experience, approximately 25 years. If the plant is operated with care, this could be lengthened to approximately 30 years; however, in this case it will gradually deteriorate and production will decrease. After that, complete reconstruction or replacement of the used block or unit becomes necessary, according to current practice.

Considering the above and the increasing demand for coke, the State Planning Committee decided in 1974 that new coking capacity must be constructed. The new facility must have larger production and be more modern, and must have all required production, supply, and service facilities, and the existing ones must be modernized and expanded.

This investment project was delayed, primarily because of foreign-trade reasons. The investment proposal combining the technical and economic aspects was developed by KOGEPTERV, the general contractor, with a deadline of early 1981. However, the main part of the work has already been started earlier. Deliveries of the machinery and equipment have started in 1979 on the basis of a Hungarian-Soviet intergovernmental agreement concluded for the coking project, which covers the entire coking block and the dry coking apparatus associated with it, as well as part of the gas-purification plant. Local preparations for construction have started in 1980. It is expected that the new capacity will come on stream during the early part of the next five-year plan period.

Within the development project, a new coking block, having the capacity of 1000 kt per year will be built. According to present views, its capacity can be increased to 1300 kt per year by introduction of coal preheating. All other facilities are already designed to handle the increased capacity of 1300 kt per year.

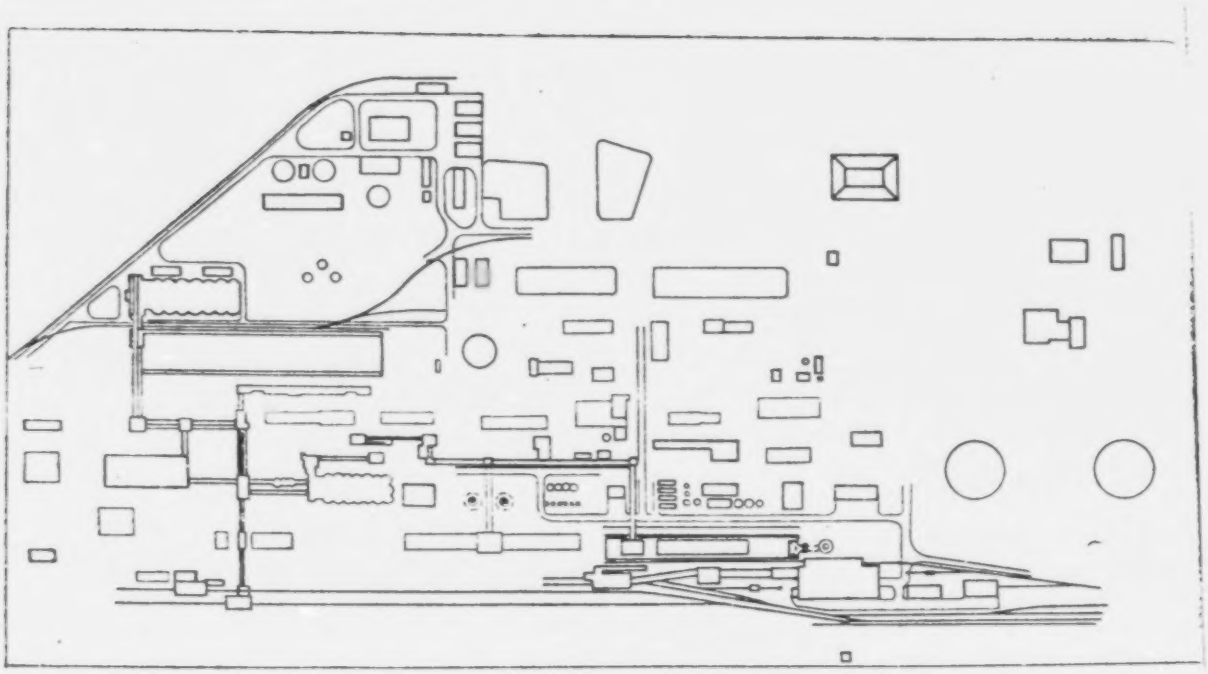

Fig. 1. Layout of the coking plant of Danubian Ferrous Metallurgical Works

[Keying numbers missing in the original]

Key:

1. Freight-car dumping facility
2. Closed coal store
3. Open coal store
4. Coal-washing facility
5. Dispensing bunkers
6. Fine grinding facility
7. Existing coking blocks I and II
8. New coking Block III
9. Dry coking facility
10. Coke classifier
11. Gas condensating facility
12. Removal of hydrogen sulfide, ammonia, and benzene
13. Removal of sulfuric acid or sulfur production
14. Administrative and social facilities
15. Gas tanks

Below we describe the manufacturing process to be realized in the project and the major facilities. Figure 1 illustrates the layout of the coking plant and the major facilities.

The Coal-Preparation Plant

A new circular dumping facility (1) empties the incoming freight cars delivering the coal. The freight cars are brought to the dumper by remotely controlled car-moving equipment, and removed from there in the same way.

The various coal types are transported from the freight car dumping facility with an enclosed conveyor belt system to 21 encolsed cylindrical closed coal stores (2) where the various coal types are stored separately. By dispensing coals of various types simultaneously from several bunkers, the coal can be homogenized and thus quality fluctuations can be avoided.

From among the coal types stored, the semiconcentrate from Komlo is transported to the coal-washing and -drying facility (4), where cokable concentrate is obtained by means of enrichment with a heavy-suspension cyclone concentrator and flotation. The byproducts go to the power plant as coal fuel.

The other coal types as well as the enriched coal from Komlo go from the closed coal store to a row of bunkers (5) via a conveyor-belt system.

The open coal store (3) remains to be available for meeting the need for additional storage during peak delivery periods. This store is somewhat smaller than the enclosed store, and is also filled from the freight car dumping facility via a conveyor-belt system.

The dispensing bunker row has 21 cylindrical bunkers made of reinforced concrete. This is where the coal mixture is prepared by metering the various coal types as required for the coking technology. Two part mixtures are prepared on the basis of the petrographic parameters. One mixture contains so-called soft or easy-to-crush coals, and the other contains so-called hard or difficult-to-crush coals. The two part mixtures are transported by a conveyor-belt system to the fine grinder (6), where different crushers are used for the different mixtures. The two part mixtures are combined to make up the final mixture in a mixer. The final mixture is transported by a conveyor belt system into the bunkers of the coal tower of the new coking block III (8). The existing blocks I and II (7)will continue to operate while the new block is started up. They use a different coal supply. If the block II remains in operation, it will continue to have facilities for supply.

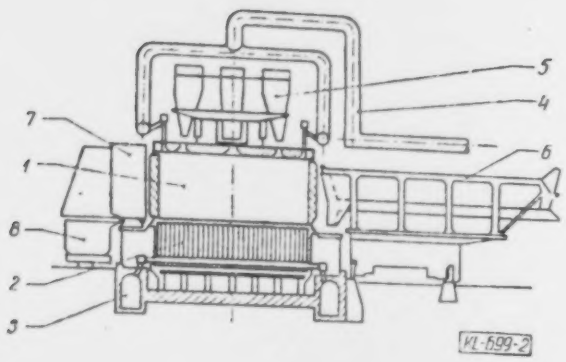

Fig. 2. Cross-sectional view of the new coking block

Key:

1. Coking chamber
2. Regenerator
3. Smoke flue
4. Gas collection system
5. Loading carriage
6. Coke sieving
7. Frontal carriage
8. Coke transport carriage

The coking Plant

The bunkers to receive the coal mixture are located in the upper part of the coal tower, made of reinforced concrete. The charging carriages are loaded with coal dispensed from these bunkers on the basis of precise metering. The electrical switching center, the instruments of the measuring and control equipment, the firing switch, and the other facilties required for the process are accommodated in the lower part of the coal tower.

The coking block (Fig. 2) is a modern, large, bottom-fired unit, having 65 chambers (1), each with a useful volume of 41.6 m^3. Chamber volume is regarded as an important measure of the modernity, and the current value for new blocks is 40-50 m^3. Cahmber gas is used to heat the chambers. The air required for the combustion is preheated in regenerators accommodated under the chambers (2). There are 32 heating ducts in the heating walls between the chambers. The planned chamber turnover is 14 hours. The flue gas generated goes to the chimney via the smoke ducts (3).

The leveling bar of the coke ejector (6) levels the coal loaded into the chambers by the loading carriage (5). After degasification, the incandescent coke goes to the front carriage (7), pushed there by the ejector head of the coke ejector, and thence to the containers of the coke carriage. This carriage transports the incandescent coke to the dry coking facility.

In addition to their main task, the furnace machines perform many other functions. The loading carriage automatically opens and closes the dispensing units of the bunkers of the coal tower, and cleans the rise pipes serving for the discharge of the chamber gas. The coke-ejector machine and the front carriage remove and reinstall the chamber doors, clean the doors and door frames, regulate the loading of the anchor bolts, and so forth.

The coke-ejector machine, the front carriage, and the coke carriage remain monoaxial while the incandescent coke is pushed out. This is ensured by a high-frequency gating system. The coke cannot pushed in the wrong direction.

The raw chamber gas developing in the course of coking goes to the gas purification and byproduct plant via the gas-collector unit (4).

The data required for controlling the operation of the coking block (the temperature, the pressure, the draft, and so forth) are displayed and recorded in centralized instruments. The control is largely automated.

Once the incandescent coke has been pushed out, it goes into the dry cooling unit developed in the Soviet Union (see 9 in Fig. 1). There, nitrogen gas flows through the coke, cooling it to approximately 180-260°C. The heat in the gas is utilized in the smoke-gas boilers, where steam at a pressure of 40 bar is generated.

The advantage of dry cooling in metallurgical operations is that the properties of the coke processed in this manner are better, the coke is stronger, has a better particle-size distribution, and is practically free of moisture. In addition, the waste heat, is utilized, and -- since the cooling is in a closed space -- the environment is not polluted.

The Coke-Classification Plant

The coke coming from the dry cooling unit first goes to a dust-removal system, where the coke dust is separated by vacuum.

The coke, which is practically free of dust, is classified into grain-size fractions with roller-equipped vibrating sieves. The 25-18 mm coke fraction is used in the manufacture of pig iron, the so-called walnut-size fraction of grain size 10-25 mm, is sold to the general public, and the 0-10 mm fraction is used for ore preprocessing. The amount of metallurgical coke required at Danubian Ferrous Metallurgical Works goes into the bunkers there via conveyor belt. The excess coke of all fractions is loaded into freight cars and shipped away.

The Gas-Purification and Byproduct Plant

To eliminate harmful effects in use (firing), the chamber gas generated in coking must be purified. The substances removed in the course of purification are processed to obtain byproducts for use within the Ferrous Metallurgical Plant or for sale in domestic and foreign markets.

First, the tar is removed from the raw chamber gas. This is accomplished by washing, cooling with transverse-tube coolers, and electrostatic filtration within the gas-collector pipes. The tar thus obtained is processed in the tar-distillation unit. This gas-condensing plant (11) also includes the pressure-increasing exhaustor.

The next stage is the removal of hydrogen sulfide and ammonia (12) by means of various chemical and physical methods in combination. The ammonia is used for the manufacture of ammonium sulfate. The hydrogen sulfide is transported away for further processing.

After removal of the ammonia, the raw benzene is removed by oil-washing. The product is transferred to the benzene-processing plant.

The purified chamber gas goes into the gas reservoir (15) and thence to the ultimate consumer.

There are two possible ways for the utilization of the hydrogen sulfide gas. In the investment proposal, manufacture of sulfuric acid at a concentration of at least 92 percent is considered (13). Studies are in progress to evaluate whether the manufacture of sulfur would not be more desirable. Bids are presently solicited for the required equipment. The sulfur could be used in agriculture, in the rubber industry, and also for the manufacture of high-purity sulfuric acid. If the studies indicate that the approach is economical, it will be used; if the manufacture of sulfuric acid by the catalysis method is more economical, this will be implemented.

A new administrative and social center (14) is built next to the gas purification and byproduct plant.

In addition to ensuring that modern technological methods and equipment are used, care has to be exercised to ensure that contemporary methods of control and management are used, and that due attention is given to the protection of the environment.

The data of the measuring and control instruments are fed to a central control station, where they are displayed and in part recorded. Based on these data, the equipment is operated via remote control from the station.

Within the framework of the pollution-control measures, the equipment where dust and gas is emitted will have exhaust devices and precipitators. Purification of the industrial wastewaters will be accomplished in a new biological wastewater purification system. The water will meet the applicable purity standards when it is discharged.

The following amounts of coke, chamber gas, and byproducts will be produced yearly in the new coking block:

Metallurgical coke	885,000 tons
Walnut-size coke	45,000 tons
Small-grain coke	70,000 tons
Purified chamber gas	219,500 standard cubic meters
Tar products	40,165 tons
Ammonium sulfate	13,400 tons
Benzene and its homologs	9,700 tons

In addition to the above, the products will include sulfuric acid or high-purity sulfur -- depending on the method selected for processing the hydrogen sulfide -- and steam (in case the dry coking method is used).

If the coal supply of the presently operating coking block II can be ensured, the coke production could become 1,300,000 tons per year, and the amounts tabulated above could be increased by 30 percent.

The planned investment project considerably facilitates the coke supply of the metallurgical industry. Hungary will have a modern coke factory operating at a high level of technological sophistication.

2542
CSO: 2502

DIRECTOR OF LABOR MIM DISCUSSES OL-630

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 4

[Interview with Mihaly Modi, director of the Labor MIM [Labor Instrument Industry Works]: "A Real Profile Change"]

[Excerpts] [Question] How did the new profile come to the enterprise? When did development of the semiconductor store [OL-630] begin and who initiated manufacture? Did production start in response to orders, as a result of a market survey of on factory initiative?

[Answer] When starting such themes the initiative always comes from market demand. In addition there was an external and internal intellectual capacity capable of digesting such market demands. It also contributed to success that this intellectual base knew the computers recently installed in Hungary and had profound knowledge of computer technology. I would like to note that there was a very strong computer technology development program in the old Ministry of Heavy Industry and the leaders and executors of this program acquired the hardware and software expertise which made possible the development of the semiconductor stores. The enterprise showed suitable sensitivity to this and carried out a vigorous development, knowing the real market needs. Not quite 2 years elapsed from the first idea to installation of the first product. I believe this is a rather short time, because in 2 years we had to develop a manufacturing base--with all the objective and personnel conditions --which could satisfy not only the market demand then but also the demand to be expected.

[Question] What sort of difficulties did the alien profile cause in the factory and how does it look now according to judgment inside the factory?

[Answer] The difficulties of introducing the product did not exceed the difficulties of introducing our classical products. A slight change in attitude was needed in the enterprise and in manufacture also. Parallel with this theme could not be developed or manufactured in the old ways. So, within the relatively rigid enterprise organization, we created possibilities which deviate from the customary.

[Question] What sort of possibilities? What is the planned annual manufacturing volume between 1981 and 1985? With what sort of delivery time limits do you accept orders?

[Answer] I have said already that we created a manufacturing capacity aimed at the needs of the future. At present we can satisfy every market need over a relatively broad scale, in general within 6 months of the orders. The planned annual manufacturing volume was 40 million forints in 1980; we approached 100 million in 1981; and we plan 150 million for 1982, which is existing orders. If the enterprise should get more orders then we can increase capacity to about 200 or 300 million forints.

[Question] The next question relates to this also. What is the manpower situation--with special regard to training and numbers?

[Answer] We adjusted our personnel development to the project. The situation is favorable, because this program is attractive to electronics experts, so we can hire 10-15 college or university graduates for this area each year. The expansion of volume will always determine hiring and preparations for the future. I can say with assurance that the personnel conditions are more favorable than many other conditions, because the Hungarian supply of electronic basic materials is just now developing.

[Question] Parts supply is the basis for manufacture. Do you feel it advantageous that so large a factory should get what it needs from a stockpiling enterprise?

[Answer] I believe that the acquisition and stockpiling enterprise, ELEKTROMODUL, understands what national economic significance this product has and thus far the supply of parts has been assured without a hitch. This is a great advantage. Hopefully we will have no problem in the future either.

[Question] What further ideas do you have in regard to supplementing the new ESZR [Uniform Computer Technology System] and MSZR [Minicomputer System] models?

[Answer] Memory expansion ideas for the ESZR and MSZR models have been developed and we have carried out developmental programs. Briefly I can say that we can provide stores for every type of ESZR computer in the country. Our achievements in connection with the ESZ 1020 and ESZ 1022 are well known. This year we will complete development of a store which can be attached to the ESZ 1035, but we are already dealing with memory expansion for the ESZ 1055. The ESZ 1060 machines will appear soon, and we would like to expand them also.

[Question] Do you have ESZ 1040 developments also?

[Answer] Yes. Considering that this is not a Soviet but a GDR system there are a number of problems. If we get enough orders then, naturally, we will make adaptors for these machines also.

[Question] And what about the MSZR types?

[Answer] Memory expansion for the SZM-4 has been solved. The first store--which we entended for a "torture test"--has been operating without trouble for

a couple of months. I see no obstacle, if an enterprise importing and selling MSZR types indicates a need we can satisfy it in the future.

[Question] What sort of contacts are there with developers and users?

[Answer] Our contacts with the developers are extraordinarily favorable. There are very many components to this. In addition to various friendly contacts we have discovered a common interest also. With maximal exploitation of our present possibilities we built up an interest system in which the moral and material interest of developer and manufacturer are common.

On the basis of experience contact with users is very favorable; the users measure the time needed to install memory expansion in minutes and thus far there has been no indication that any of our installed stores caused trouble to the work of the users.

[Question] This reference to minutes prompts a question. Have you really ever installed a semiconductor store in 10 minutes?

[Answer] Unpacking takes longer than installation, but since installation includes unpacking the answer is no.

[Question] Do you plan deliveries abroad?

[Answer] In regard to foreign deliveries, our discussions are aimed at ad hoc memory expansion for ESZR and MSZR machines; if we can harmonize the conditions with national economic interests such deliveries may take place in the future.

[Question] Which enterprise handles domestic sales? What sort of cooperation do you have?

[Answer] Domestic sales are handled by the SZAMALK [Computer Technology Applications Enterprise], as the responsible enterprise. We signed a civil law cooperation contract with the OSZV [National Computer Technology Enterprise] (the SZAMALK is its legal successor) a year and a half ago and the contract sets forth unambiguously the tasks of manufacturer, installer and maintenance. This is a living contract, always adjusted to life. Our cooperation is extraordinarily good. I believe that there is a meeting of interests in this, and an outstanding role is played by a vigorously developing national economic interest.

[Question] Does this mean that the Labor MIM has no direct contact with the user but always goes through the SZAMALK?

[Answer] Both really, because as manufacturer we do not want to be separated from the users; it is crucial to our future developments that there be a link between user and manufacturer. In the interest of this we are making efforts beyond what is contained in the contract, which involve significant material expenditure. In the future we would like to expand these contacts too.

[Question] Kowing the new product, how would you define the developmental profile of the enterprise?

[Answer] It is not only the technology and function of the new product which have an effect on the enterprise developmental program, the new attitude does also. Concrete signs of this attitudinal effect are appearing also. I would mention as an example the large capacity autoclave control, which we started in the new spirit. We based the control not on 30 relays but rather on a microprocessor. This product has resulted in a generational change in terms of modernness and cost of production.

[Question] And what is the situation in regard to quality?

[Answer] This is a special product and it requires special quality. Design, manufacture and the enterprise organs responsible for quality had to adjust to this and we had to use a system which guarantees that quality always corresponds to the planned norms.

[Question] How do you see the domestic future of the products manufactured?

[Answer] Our goal is to take measures at the drawing board which will result in greater quality improvement and reliability so that the product coming off the drawing board should guarantee the reliability of a very valuable system. When starting this program the enterprise had two goals in addition to the internal enterprise goals. One was that this program be compatible with the developmental program for Hungarian electronics. The other was the realization of an ad hoc development, manufacture and adaptation project. In my opinion this supports the developmental program for domestic electronics and fills those gaps which the large enterprises dealing with the production of electronics products cannot satisfy and do not even want to satisfy at this production volume.

8984
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EVALUATION OF OL-630 STORE

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 5

[Article by Kalman Nandori and Ferenc Zilahy: "A Status Report From the Users of the Semiconductor Store"]

[Text] Since December 1980 the OL-630 operating store made by the Labor MIM [Labor Instrument Industry Works] has been placed into operation at nine enterprises. We asked a few users with operational experience what experiences they had in the course of acquisition and use.

In what follows we publish excerpts from the questions of those conducting the survey and from the answers of the users. We chose this unusual form of publication to give those interested in acquiring the store most direct access to the opinions of the users.

--the editors

"After studying what references did you decide to acquire the semiconductor memory?"

"We looked at the prototype in operation at the NIM IGUSZI [Ministry of Heavy Industry Institute of Industrial Economics and Systems Analysis]."

"We consulted on a number of occasions with the experts at the NIM IGUSZI and as a result of these discussions we ordered the store from the OSZV [National Computer Technology Enterprise] (the SZAMALK [Computer Technology Applications Enterprise] is its legal successor)."

"We decided on the basis of personal talks with the designers of the OL-630."

"We decided on acquisition on the basis of practical experience in the NIM IGUSZI computer center."

"In our computer center we developed an information system based on a DBOMP data base management system. The programs and program systems have a long running time and are so extensive that they could be prepared only in an OVERLAY structure. Using the 1 M byte operating store of the NIM IGUSZI

we tested elimination of the OVERLAY structures and as a result of these tests, and taking into consideration the technical reliability, we decided to acquire the semiconductor memory."

(There were no answers from two of the users.)

"How much time elapsed between order and delivery?"

It appeared from the answers that this time ranged from 2 to 6 months, with an overage of 4 months.

"How long did it take to put it into operation?"

The average was 5 hours for five users.

"Putting the first 512 K bytes of memory into operation took 2 hours, the second took 6 hours."

"Putting it into operation took two shifts, because our machine had a problem --for other reasons."

"When was it put into operation and how many faults have you noted in the units since then?"

"December 1980. There were a few insignificant faults in the first days, since then none."

"There has been one failure since it was put into operation in February 1981, a power unit contact defect; we cleared it up during maintenance."

"It has been working faultlessly since February 1981."

"February 1981; it is working well."

"There have been three failures since March 1981."

"It was put into operation in August 1981. A failure appeared on one occasion since then, and it was cleared up very quickly by experts arriving on the scene. The source of the failure was a switch with a manufacturing defect."

"What changes in your processing were brought by putting the memory expansion into operation? Did the conditions for programming or operation change?"

"We can run more extensive programs."

"System development and programming operations connected with the switch to OS were accelerated."

"The greater storage capacity facilitates programming work since the upper limit of 128 K bytes is no longer a limiting factor."

"The level of operations improved substantially; processing backlogs have decreased as a result of multi-ing."

"The ratio of multiprogramming increased significantly."

"The sizes of the programs have not changed but now they run reliably. The original ferrite memory was no reliable; there was an average of one or two fallures daily."

"We can run the extensive programs in less than half the time. In the case of less extensive programs we make effective use of the advantages of multi-programming. These two factors resulted in freeing 20 percent of the effective machine time, which we use for program development."

"Are you working with the same or a different operating system? Are you using operational modes or program products not used prior to memory expansion?"

"The operating system is unchanged; processing is substantially more efficient because of the possibility of multiprogramming."

"With memory expansion it becomes possible to introduce such modern systems or programs as, for example, OS and ISMS."

"We supplemented the DOS operating system with the possibility of POWER spooling."

"We still use the former DOS operating system, but since the expansion we regularly run under OS also. We are using the IDMS data base management system and have introduced use of TSO."

"At present we are working under DOS and we are using the IDMS/DOS system. We plan to introduce OS and operation under IDMS OS."

(Answers were not received from two users.)

"Do you plan to develop the remote data processing possibilities?"

"No."

"Yes."

"We plan technical realization of remote processing in this 5-year plan with the introduction of a multiplexor ond terminals."

"We will begin to develop a remote data processing system in the near future."

"There is no decision as yet."

"We are planning remote processing work in 1982-1983; a reliable store of 512 K bytes is indispensable for this. For this reason expansion of the 256 semiconductor store figures in our plans."

"We are planning adaptation of the CICS."

"In your opinion, can introduction of the semiconductor store extend the operational life of your ESZ 1022 computer? If so, by how much? If not, what efficiency increase are you counting on?"

"Utilization of the computer is substantially greater; we want to expand memory up to 1 M byte."

"Our operational experiences thus far (breakdown statistics, etc.) show that operational is determined not by the central unit but rather by the life expectancy of the peripherals. The latter, unfortunately, does not even reach the 7 year amortization time now used; they (for example, the typewriter) can be operated after even 3 years only with basic renovation. In our institute the exchange of memory resulted primarily in a reliable unit. With the exchange one can estimate the operational life of the CPU at about 8-10 years."

"Yes, but the supply of peripherals has a determining role."

"Indirectly yes; but putting the semiconductor store into operation results in eliminating the 15-20 percent system downtime due to machine fault."

"Efficiency increases because the downtime due to store fault is virtually zero."

"We have experienced a substantial increase in efficiency; the possibliity of multiprogramming increased. The memory expansion unit is a highly reliable, good design, uses little power, can be services well and is a well serviced system element."

"According to our experience the weakest point of the ESZ 1022 computer was the ferrite store. With use of the semiconductor store, in our opinion, the operational life can be extended physically by about 4-5 years. At the same time the moral depreciation limit may be shifted significantly also, because the operational memory of the machines can be expanded to 1 M bytes and it becomes possible to run program systems which otherwise could be run only with a larger machine, or virtual machine. According to our estimate the time limit for machine exchange due to moral depreciation can be extended 2-3 years."

"Now that you have operational experience as well, to what extend are you satisfied with your decision resulting in the expansion, are you satisfied with the store provided by the Labor MIM?"

The users were unanimously satisfied:

"In connection with the store exchange and putting it into operation, we feel that we got a product at the level to be expected in computer technology."

We received answers from workers at UTORG, Zalaszam, the OTAF, VOLAN, KOGEPTERV [The Metallurgical Machinery Design Bureau], EDASZ [Electric Power Service Enterprise of Northern Transdanubia] (Gyor) and the OKISZ [National Federation of Artisan Cooperatives].

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CSO: 2502/63

SPECIFICATIONS OF OL-630

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 5

[Article by Zaltan Emodi: "Store Characteristics"]

[Text] One obstacle to more efficient utilization of the ESZ 1012 computers--which make up a significant part of the domestic ESZR [Uniform Computer Technology System] machine park--has been the relatively small capacity of the operational store. In general the installed machines were operated with a store of 256 K bytes, in some cases only 128 K bytes.

Because of the long delivery times and high price (at the end of 1978 the price of a 256 K byte ferrite unit was over 10 million forints) few undertook memory expansion. But even then the central unit could accept a store with a capacity of only 512 K bytes.

Because of this, and recognizing the possibilities, the technical department of the NIM IGUSZI [Ministry of Heavy Industry Institute of Industrial Economics and Systems Analysis] developed a modern, semiconductor store and modified the address domain of the central unit thus making it possible to expand the use of operational storage to 1 M bytes. Seeing the significance of the developmental achievement the Labor Instrument Industry Works (Labor MIM) began manufacture of the new stores. The new semiconductor stores are made in a cabinet a good bit smaller than the original and each cabinet can have a maximum capacity of 512 K bytes.

The more important technical data of the OL 630 semiconductor memory of the Labor MIM are: multiplex store, 16 K bytes; protection key store, 256x6 bits; cycle time, 2 seconds; access time, 800 microseconds; access time for protection key store, 80 nanoseconds; power supply, 200 volts plus or minus 10 percent, 50 cycles per second; power used, 350 watts; cabinet size, 1,100 x 586 x 586 mm; and weight, about 75 kg.

The OL 630 store is compatible at the connector level with the ESZ 3222 ferrite store of Soviet manufacture. The semiconductor design would make possible much faster operation than that specified but the ESZ 2422 central unit cannot use this.

In its operating and multiplex store the storage unit uses 4 K bit capacity static MOS elements. At the time of its design there were already 16 K bit

capacity dynamic semiconductor stores, but use of smaller capacity, static elements seemed best as they were striving for simplicity of design and especially for greater reliability.

In the interest of reliable operation of the device the integrated circuits built into it are tested before they are built in and after soldering up. Several special purpose microprocessor instruments were made for testing. Especially time-consuming is the test which studies "cross talk" between individual storage cells within a casing, in the case of differnet bit samples.

Before connection to a computer the finished, assembled devices are tested on an off-line tester and are connected to an ESZ 1022 computer only after 24 hours of continuous operation.

Faults appearing in initial operation after installation cause much inconvenience for users so prior to shipment every store gets test operation on an ESZ 1022. The "burning in" is done by experts of the SZAMALK [Computer Technology Applications Enterprise] on an ESZ 1022 computer, for a minimum of 80 hours per unit. According to experience thus far this is enough.

Operating experiences during the first year were very favorable; failures were very rare and in general they could be eliminated by local experts in 15-20 minutes. The readable, easy to manage documentation and the adequate supply of spare parts offer great help in this. Equipment has never stopped anywhere due to a shortage of parts.

There was only one serious problem in the course of initial manufacture--the connectors for the printed panels came from two different manufacturing series, one of which was faulty and easily split lengthwise.

The manufacturer will immediately replace store frames equipped with faulty connectors for sound ones as part of the guarantee.

The users are very satisfied with the equipment delivered thus far and SZAMALK offers service exceeding the domestic average.

With its greater reliability, lower price (about 4 million forints) and shorter delivery times the OL 630 store has become the leader for domestic ESZ 1022 machines. Recognition is due to the OSZV [National Computer Technology Enterprise] (SZAMALK is its legal successor) for quickly undertaking, in the absence of references, and helping to supply domestic users of the ESZ 1022 with cheaper, more modern equipmnnt.

On the basis of the experience gained the Labor MIM had developed and is manufacturing a semiconductor store for the ESZ 1020 and a version compatible with the SZM-4.

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USES OF THE OL-630

Budapest SZAMITASTECHNIKA in Hungarian Jan 82 p 6

[Text] The ESZ 1022 computer of Soviet or Bulgarian manufacture makes up nearly 50 percent of the larger ESZR [Uniform Computer Technology System] machines, the homogeneous machine type which defines domestic computer technology resources. This model--on the basis of its technical parameters--can be classified among the small-medium computers; its ferrite store can be expanded to 512 K bytes; the maximum capacity of the magnetic disc background store which can be connected to the system is 29 M bytes per drive unit. On the basis of these two parameters it can be established that the system is suitable for local processing in the batch mode and for the development of a data base management system of limited size.

Increasing the capacity of the system--it being so widespread--would significantly influence the efficiency of domestic computer technology applications.

There are two ways to increase its capacity--by increasing the reliability of the system and by expanding its resources.

Reliability--primarily in the case of I/O devices--can be increased by increasing reserves. In the case of the functional elements of the central unit, however, this solution is difficult to apply in an economical manner. On the basis of service experience, more than half of the central unit problems can be traced to faults with the operational store.

Naturally, expanding the resources of the system can be realized only with certain limitations. One can increase the number, variety and capacity of I/O devices participating in processing, but at the level of use one cannot change the average time for the execution of instructions.

One possible way to increase resources is to increase the capacity of the operational store. Of the 46 ESZ 1022 systems delivered to Hungary only 16 had the maximum ferrite store permitted to the model (a capacity of 512 K bytes). At the same time, the remote data processing applications which will spread in the first half of the 1980's will make demands on the central unit exceeding 512 K bytes.

Increasing reliability and the available resources make it necessary to increase the operational store of the ESZ 1022 systems. Since stores can be

acquired from the countries manufacturing the system only at a relatively high price and after a long wait we are using the domestically developed OL-630 semiconductor store to increase operational storage. The OL-630 can be connected to the ESZ 1022 computer without modifying the receiving electronics, making possible the development of mixed (ferrite and semiconductor) systems. With a minimum modification of the central unit the OL-630 makes possible the construction of a machine with 1 M bytes of operational storage.

What advantages accompany use of the OL-630 in ESZ 1022 computer systems?

--The 1 M byte operational storage capacity makes possible the development of more efficient remote processing and data base querying and actualizing systems, and thus the creation of information systems, in addition to local processing.

--The greater reliability of the OL-630 increases the reliability of the entire system and with suitable design makes it possible to create reserves even in the case of the operational store.

--The semiconductor store is less sensitive to the introduction of circuits and to environmental, primarily temperature, changes; there is less need for maintenance and the number of errors, which hinder continual operation, are fewer.

--If the storage module should fail repairs can be made by a card change, essentially without stopping the system. Changing a faulty storage element can be done in a fraction of the time needed to repair a ferrite store (for example, core breakage of fiber parting).

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BRIEFS

TOXIC WASTE DISPOSAL CENTERS--The Institute for Environmental Protection has announced a plan for setting up facilities for treating and disposing of toxic wastes. Hungarian industry generates annually a total of 300,000 tons of waste toxic to humans, animals and vegetation. The Institute proposes to set up five facilities for dealing with it by 1995. They are to be located in Budapest, Papa, Pecs, Hodmezovasarhely and Leninvaros and will include laboratories, incinerators and dumps. The estimated cost of the network is 3.2 billion forints. [Budapest MAGYAR NEMZET in Hungarian 1 Apr 82 p 3]

CSO: 2502/76

COMPUTER DEVELOPMENT, APPLICATION DESCRIBED

Demand for MERA-60 Minicomputer

Katowice TRYBUNA ROBOTNICZA in Polish 17 Feb 82 pp 1, 6

[Text] A few days ago, a delegation returned from the Soviet Union composed of employees of the Scientific-Production Center of "MERA-STER" Control Systems in Katowice and from the Foreign Trade Agency "Metromex" in Warsaw. As we were informed in Moscow, one of the biggest trade transactions in the history of Polish automation was signed.

The agreement entered into with the Soviet trade center "Techsnabexport", which represente the interests of the Academy of Science and of scientific institutions of the Soviet Union in international contacts, amounts to the additional delivery, this year yet, of 174 "MERA-60" computer systems with a cumulative value of 700 million zlotys. This places the manufacturer of the minicomputer, the "MERA-STER" Center in Katowice in the order of the largest domestic exporter of computer control systems. In the course of discussions, a preliminary agreement was also signed for further deliveries of the "MERA-60" computer during the years 1983-1985. In approximate terms, the deliveries will reach about 4.5 billion zlotys.

Owing to this contract, the control system "MERA-60" is becoming the basic minicomputer with which Soviet scientific institutes are being equipped--both Academy of Science institutes as well as industrial institutes.

What was it that decided about such a great success of "MERA-60"?

"Two years ago", states the director of the Scientific-Production Center of MERA-STER Control Systems, Dr (Habilitatus, engineer) Ryszard Pregiel, "we delibered the "MERA-60" minicomputer to the Institute of Nuclear Research in Dubno. It is the evaluation of this institution, following a 2-year period of operation of our equipment, that contributed to the undertaking of the decision about introducing it for operation in a majority of scientific institutes of the Soviet Union. Three factors constitute the basis for success: computer softward which gives it priority in the class of computer systems manufactured in socialist countries; a high rate of reliability in connection with the transition from a ferrite base to a base of semiconductors using the highest quality of elements available in socialist countries, mainly in the Soviet Union and the fact that the system is based on modules which have already earlier achieved a standard status in Soviet laboratories.

Development of RYAD System

Gdansk GLOS WYBRZEZA in Polish 23 Feb 82 p 3

[Text] The future of computer systems in Poland will be linked, to a large extent, to the development of the "RYAD" uniform system of EMC [electronic digital computers] both in terms of production as well as in terms of its application. This arises not only from settlements within the framework of CEMA but from economic circumstances. Poland has been participating in the "RYAD" program from the moment of its inception.

Member countries of CEMA took up cooperative action in the area of scientific elaboration, production and use of computer equipment 12 years ago. The agreement of cooperation was signec by the following countries in December 1969 : Bulgaria, Czechoslovakia, GDR, Poland, Hungary and the USSR. These countries were later joined by Romania and Cuba. A program of cooperation was mutually worked out whose goal was to create a "RYAD" Uniform System of Electronic Digital Computers [JS EMC]. The joint activity is directed by an international commission whose organs are, among others, the Council of Chief Designers, the Working Group for matters relating to the Automation of Control Systems and the Coordinating Center.

What part does Poland play in this joint activity?--Poland manufactures both central units (computers) as well as peripheral equipment. The series production of the R-32 computer was undertaken in the Wroclaw plants of Mera-Elwro in 1975. The peripheral equipment manufacturing industry has developed to a significant degree. The Mera-Blonie plants have become one of the largest manufacturers of this type of equipment. It [the equipment] is produced predominantly for export. The sale of information science equipment was in the past 10-year period, the most profitable export of the electro-machine industry. The elaboration of domestic research facilities and purchased licenses enabled the production of modern equipment : mosaic printers, computer display monitors, floppy-disk memories, microcomputer systems for controlling machine tools and machining centers. The post-license development of these manufactured products may, in the upcoming years, make possible the production of modern printers controlled by microprocessors, a new family of computer display monitors, floppy-disks with double density and specialized terminals controlled by microprocessors.

The achievements of the Polish computer industry--regardless of the state of information science in our country, whose application is still quite far removed from the needs and possibilities--were, among others, the creation of a considerable manufacutring potential in the Mera-Elwro plants; the elaboration and production of ferrite operating memories for the Uniform System and Minicomputer System of Electronic Digital Computers and the elaboration and production of Mera-60 and Mera-400 minicomputers. In addition, many systems were elaborated, among others, a data base for uniform system computers and the production of the already mentioned printers, memories, etc., was also undertaken.

In the development of the computer industry, it was rational to assume that a country such as Poland cannot take on the production of the full assortment of equipment needed by information science. For this reason, a special line of production and the replacement of instalation within the framework of CEMA is beneficial. The special line [of production] allows for the extension of the production series and for the lowering of hardware production costs.

Polish specialists are engaged in work on a third series of "RYAD" Uniform System computers; they work jointly on software equipment; they are the designers of systems which, among other things, aid design and scientific work.

For the future of computer industries in socialist countries including Poland and for the development of electronics and information science, in general, new undertakings are also of great significance, aside from cooperation within the framework of the "RYAD" Uniform System of Electronic Digital Computers. During the 35th CEMA session, which was held in Sofia in July 1981, among others, an agreement was made in regard to cooperation in the area of creating a uniform base of electronic computer products.

Computerized Steel Production Line

RZESZOW NOWINY in Polish 26-28 Feb 82 p 1

[Text] (Own information)

The production potential of the "Stalowa Wola" Steelworks [HSW] is being expanded by a, so-called, FZ-200 computer system. This is the first in Poland and the largest produced by the GDR industry, automated line of production of gear wheels with a projected capacity of 320 thousand wheels per year. Give computers will control the work of 60 machine tools, manipulators and that of the entire system.

"At the present time, activating work is being concentrated on the technical placing into operation of particular technological units", informs the director of the FZ-200 system in HSW, engineer Ryszard Dul. "We have already placed 40 single technological units in operation. The system of computer control is being set in motion."

How many specialists from GDR are currently working on setting this computer production line in motion? How is cooperation with them working out?

"At HSW there is a group of over 40 professionals from GDR", continues eingineer R. Dul. "There is still a lot of work remaining for the duration of several weeks. The progress of this final work is being coordinated by the director of the computer systems of the Berlin plants "7 Oktober", engineer Dieter Rietzel. I will add that this is the third line of this type produced by GDR factories while the first two, considerably smaller ones, are in GDR and in Czechoslovakia. As far as cooperation with the specialists from GDR is concerned, everything is going well. This does not mean thatin certain technical matters, we do not have, at times, differences of opinion which, in effect, however, contribute to the successful solution of production problems.

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EAST EUROPE REPORT
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PROGRESS IN SEISMOLOGICAL RESEARCH REVIEWED

Tirana ZERI I POPULLIT in Albanian 17 Apr 82 p 3

[Article by Eduard Sulstarova, director of the Seismological Center: "The Fields of Our Seismology"]

[Text] In the past five-year plan, the main task in the field of seismological research was the execution of studies on the regional seismology of the country. In this framework, about 2 years ago, the study of the "seismological zoning of the People's Socialist Republic of Albania," was completed and is being better and better implemented in our constructions, together with the seismological map of 1: 500 000. The study was based on abundant seismological and seismogeological material and has been drafted according to contemporary methods. On the other hand, many studies have been prepared; they are connected with the most thorough knowledge of earthquake characteristics of our country, with their distribution in space and in time, with their relationships with the geological-tectonic conditions and so forth.

In the past years, our center has properly represented itself in scientific activities outside the country, where our workers have successfully and competently communicated our studies, of which a great part now is well received and even published in scientific magazines in some European countries. With its publications, our center has relationships with more than 60 research and scientific institutions in the world.

There are now three main fields where this institution has concentrated its work: seismicity, which now is a consolidated field; seismological microzoning; and earthquake engineering.

In the research field of Albania's seismicity, our studies aim at extending the knowledge about seismological activities in our country in order to draw up a seismological map of 1: 200 000, to make the first steps toward forecasting earthquakes and toward forecasting their place, force and time (a short time forecast), and to make a contribution to the clarification of the construction of the crust of the earth in depth--an important problem for our country's geology, for tectonic construction and so forth.

While the dispersal in time and in space of expected seismological danger for the entire country (according to the main seismological zones) and for the

average engineering-geological conditions is being studied in the seismological zoning, seismological microzoning studies the dispersal of this danger on construction sites, whose dimensions are much smaller than in seismological zones. The studies carried out on the consequences of the big earthquakes in the world and in our country, (for example, the earthquake of 15 April 1979), have shown that the largest areas which were damaged or destroyed were generally situated in relatively small regions and, what is most important is that the great changes that resulted were observed in smaller distances. Now it is known that the effects of earthquakes on projects and structures depend on a complex of factors, such as the seismogenetic characteristics of regions, the physical-mechanical characteristics of the land and of its composition and construction, the characteristics of structures and of building materials, and so forth. In order to determine concretely the relationships between these factors, it is necessary that they be studied thoroughly and with the most suitable methods and techniques. This is the target of the studies of seismological microzoning and of earthquake engineering, the two new fields of this institution.

It is understandable that the studies of seismological microzoning cannot be carried out for every project. They are indispensable for the most important industrial projects, the big hydroelectric power stations, the high buildings, the big bridges, and other works with a special political and economic importance. The map of seismological zoning will be used for all other projects. The problem of the seismological microzoning of the industrial sites and residential centers is a complex one; and a number of institutions and enterprises in our country are engaged in solving it on schedule and with good quality. Thus it is intended to solve the problem of the study of the physical and mechanical characteristics of the lands and of their formation and geological construction by using the complex of methods of engineering geophysics. Nevertheless, the improvement of quality of geological-engineering studies, in addition to the introduction of the complex of geophysical methods, in a broader manner, is linked with the invigoration of the laboratory and field material base, with the training of cadres and so forth. Without complete studies in this field, studies which are necessary for the designing purposes of construction works, it is not possible properly to accomplish the study of the seismological microzoning of lands on which the building of the most important socioeconomic projects is foreseen.

In the field of earthquake engineering, a field which has just begun, research activity aims at studying the bearing effect of projects and of structural elements and of their joint action with the land during earthquake tremors. Seeing them under this aspect, studies in this field are very closely linked with those of seismological microzoning. At the present stage, cooperation is directed toward the revision of technical conditions of planning--a very important matter for the economy of our country, as a seismological land. To pave the way for these studies, it is necessary to develop gradually the accelerographic network, from which we will acquire indispensable data for studies in the field of engineering seismology (microzoning) and earthquake engineering.

The studies of seismological microzoning and those of earthquake engineering aim at providing designers with very completed data for seismological designing and at perfecting the technical and economic criteria of this design. We are convinced that, from these studies, it would be possible to design works which will resist possible earthquakes much better and will cost less to be built. The introduction of light structures in building is not being executed properly, and some difficulties in understanding and in organizing are not being overcome, although their development greatly reduces construction costs and increases resistance toward earthquakes.

In the urban studies, too, it is necessary for the entire study and design work to be better coordinated with the geological-engineering and seismological studies, as it has started in Vlore, Durres, and Shkoder. The experience acquired from the areas which were affected by strong earthquakes, where the epicenters were, especially, in cities or nearby areas, has shown that considerable damages also occurred because of the lack of seismological conception during urban planning. In the active earthquake areas, it is essential, in regard to urban studies, to take into consideration seismicity in order to anticipate the necessary space between the projects so as to find the best height for the projects to be built for the purpose of preventing them from being damaged by the phenomena of resonance during seismological tremors. We consider that itis indispensable to stress these things, because the Institute of Designs and Studies No 1, and the urban offices attached to the executive committees of the district people's council are continually working to perfect the urban plans for their residential centers. We must work with the same concern in regard to the best cooperation possible between urbanists and seismologists, so that these studies will be completed in the best manner possible.

In regard to urban planning of villages, we think that we should make better use of the experience acquired during the elimination of the consequences of the earthquake of 15 April, 1979, in the new villages which were built in general on solid ground with an urban conception of the time. It is also worth mentioning that our designers must rely even more on the experience of our people, who have always been aware of the necessity to build on solid and resistent ground.

In addition to the study and designing aspect, in regard to the resistance of projects to earthquake tremors, of equal importance also are the strict execution of conditions and of technical rules and the use of suitable materials in construction. With the invigoration of the district urban offices by builders and geologists, we believe that the conditions have been created for raising the planning level of studies and for improving the monitoring of these constructions.

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USE OF NUCLEAR PHYSICS IN AGRICULTURE, INDUSTRY

Tirana YLLI in Albanian No 8, Aug 81 p 24

[Article by Servet Dahi: "Nuclear Physics in the Service of Production"]

[Text] The Institute of Nuclear Physics of the Academy of Sciences is the most skilled center in the country for assimilating nuclear methods and techniques and for putting them in the service of production. It cooperates with dozens and dozens of production enterprises, agricultural cooperatives, various research and health institutions and so forth, both coordinating their work and providing them with products of the scientific work and experience that has been gained; it supervises the training of their workers.

The institute carries on a wide scientific activity and, through its 29 scientific themes, has affected, to various extents, the majority of the fields of work of the production centers. This very wide and very varied subject matter is a result: first, of the many requirements of the development of nuclear methods; and, second, of the practically unlimited possibilities of nuclear methods and techniques for solving the most different problems of production and research.

The treatment of such a wide theme and its deep study have required and require, on the part of the institute's workers, a constant mobilization and persistent work. And, the workers, under the leadership of the basic party organization, with the teaching of the party and of Comrade Enver in their minds and hearts, have increased their efforts more and more to assimilate this new and difficult science, its powerful methods and fine technology.

It is known that the demands from the various branches of our economy, such as the electric, electronic, and chemical industries and other industries, for the most varied plastic materials, have been continually increased.

The achievements of chemistry in this field are, undoubtedly, numerous. However, methods of radiation have given a new impulse to the execution of such processes, as the synthesis of plastic materials and the modification of materials which now are known, such as polyethylene, polyvinyl chloride, rubber and so forth. Achievements in the field of polymers, such as the production of radiated polyethylene, radiative polymerization and a number of other processes, are of great theoretical and practical interest.

A thorough and interesting study has been carried out at the Institute of Nuclear Physics for modifying the characteristics of polyethylene. As it is known, polyethylene takes an important place among the polymers which are produced today. It is a good electric insulator. At room temperature, it is chemically inert toward a number of organic dissolvents and toward a number of bases and acids; it is elastic; it is not poisonous and so forth. Therefore, it is widely used as an insulator in conductors and cables, in various electric and electronic pieces of equipment and machines and in chemical apparatuses as a protection from friction and so forth.

However, polyethylene has some shortcomings which limit its utilization in a noticeable manner, such as a low mechanical resistance at high temperatures, low thermal resistance, a great dissolution in various organic solvents during their heating process, bursting and so forth.

After many tests and studies, it was observed, from the radiation of polyethylene with specified doses of accelerated electrons at the accelerator of the institute, that many characteristics of polyethylene were changing. Polyethylene through radiation can be considered as a new plastic material. Because of the creation of indirect relationships between the molecules and the formation of "giant" molecules, a polyethylene with a new structure, consequently, with new characteristics, was obtained. The thermal resistance is increased. The radiated polyethylene preserves well its characteristics and form up to the temperature of 150° centigrade; at this temperature, the ordinary polyethylene is completely dissolved. Chemical resistance increases. Radiated polyethylene dissolves very little in organic solvents and in their boiling temperature and has many new characteristics, such as dielectric resistance.

Radiated polyethylene acquires the wonderful characteristic known as the "memory effect." After a sheet of polyethylene goes through boiling water, for example, it extends up to 75 percent of its initial length. Let us envelop, for example, the head of a cable with this sheet of polyethylene and, later on, heat it up to about 120 centigrade. The sheet of polyethylene is enclosed up to its initial length, tightening the head of the cable in a perfect manner and ensuring that it is filled hermetically.

A number of electromotors with a tension of from 380 to 6,000 volts with a power of from 1 to 500 kilowatts and a number of connecting underground telephone cables are insulated with sheets of radiated polyethylene produced at the institute. These pieces of equipment, after their successful test, continue their normal activity. The insulation of the meters of the two high tension generators of 6 kilowatts with a power of 500 kilowatts and 2,500 kilowatts has also been successfully carried out. Radiated polyethylene, in these works, has replaced mica and epoxy resins which are imported materials. The technological process of the processing of pieces of equipment with this material is very simple.

The very good characteristics of radiated polyethylene have attracted the attenattention of many enterprises of the country. They demand other forms of radiated polyethylene; therefore, studies are being continued at the institute so as to produce polyethylene tubes with memory effect, insulated conductors with thermal resistance and so forth.

Another field, where our institute is making its contribution, is agriculture, to which a special attention is being given. A very large field in this direction is the use of radioative trackers for the study of the utilization of the nutritive substances of the soil or of fertilizers by crops.

To utilize fertilizers produced by our industry in the most effective manner, for example, the superphosphate produced in Lac, the institute made a name for itself with radioactive phosphorus; and the "radioactive fertilizer" was used in vegetation and field experiments in order to have an idea about the coefficient of utilization of phosphorus in fertilizer by wheat and corn in accordance with the various schedules of fertilizing. Thus, for example, an experiment carried out at the Krutje agricultural cooperatives showed that the phosphorus in fertilizer, when it was applied at the beginning of the vegetation of corn, regardless of the manner of fertilizing, constituted only 2 percent of the phosphorus received by the crop. This means that, in this case, the effectiveness of the utilization of fertilizer is very low. The crop, actually does not use fertilizer at all and it takes almost all its nutrition from the soil. Under these conditions, there is no reason to use phosphate fertilizer.

Again, using radioactive phosphorus, the Institute of Nuclear Physics studied the activity of fertilizer phosphorus in soils of various types. Thus, for example, it was observed that in heavy argillaceous soils, phosphorus does not move at all; it stays where it is applied; while, in some sandy soils, it moves in a noticeable manner.

Another important work has been the study of the effects of radiation in the stimulation of seeds before sowing. Through a long research work, it was possible to find the best doses of radiation which lead to an increase in yields and in early growing and so forth.

And this is what the present facts show: with specified doses of radiation, the potato yields for 1977, 1978 and 1979 increased in a noticeable manner. In regard to tomatoes of the "monidor" type, produced in greenhouses, yields increased by 10 percent and the tomatoes were harvested earlier than the tomatoes which were not radiated. The yields of sugarbeets increased 10-17 percent and the sugar content also increased.

With these three examples, we showed some results achieved by the Institute of Nuclear Physics. They are concrete and satisfactory results. The institute, however, has even more comprehensive results. It has created its own physiognomy; now, it has a definite theme, has made good progress in the creation of a tradition in scientific work and, above all, has created a group of impassioned scientific cadres with high ideological and vocational training. In the past 2 years alone, almost one-third of the scientific cadres of the institute successfully defended their dissertations for the first level of post-university training.

Inspired by the directives of the Seventh Five-Year Plan, the workers of the institute continue their work with greater intensity in order to implement the great tasks entrusted to them by the party.

9150
CSO: 2102/7

NEGLIGENCE IN PROSPECTING FOR VALUABLE ORES CITED

Tirana ZERI I POPULLIT in Albanian 8 May 82 p 3

[Article by Bashkim Lleshi, director of the Institute for Studies and Designs in Geology and Mines: "From Mountain Ranges With Prospect to Unexplored Mountain Ranges"]

[Excerpts] The Institute for Studies and Designs in Geology and Mines, in collaboration with all the geological and geophysical enterprises, has stipulated that all studies for prospecting for the main ores and new ores be based on a sound geological base set on a scale of 1:25,000. On this basis, according to prospecting studies carried out, the institute, in cooperation with the geological and geophysical enterprises, will cover all eastern and northern zones of our country with complex surveying. This will open up new opportunities for prospecting and discovering useful solid ores in unexplored zones which at present appear to be unproductive.

The transition from the known to the unknown was carried out in the study of the prospects and the prognosis for chrome in the Bulqize mountain range which serves as a model for studies in all the ultrabase ranges in Albania. In this range new chrome-rich strata were found and some of them appeared to be of good and very good quality. Nevertheless, knowledge about this area is still very "poor" since prospecting work in this range has just begun.

At the present time, the system of completing such studies and other works is established on a new geological basis, on the new geological map of the People's Socialist Republic of Albania which has a scale of 1:200,000.

The strengthening of the geophysics enterprise in Tirana, so that it will better respond to the needs of the geological service of the country, will increase considerably the effectiveness of geological workings and will result in the improvement of prospecting methods and the reduction of the volume of drilling and ore workings. The reduction of the volume of these operations will permit us to strike more exactly, "with the first shell," in other unexplored regions and mountain ranges.

Our country is full of valuable ores of all kinds. However, in prospecting activity, emphasis is sometimes placed on the most important ore and the other ores are not given the proper attention. For example, the Gjirokaster geological enterprise, which is chiefly concerned with phosphorites, does not give

the same attention to all the other ores which might be found in the area where it carries out its activity; the geological enterprises in Bulqize and Burrel, which are chiefly concerned with chrome ore, have no justification for ignoring the other ores, as they do. Not only the geological enterprise in Kukes should be engaged in prospecting for olivines. All possibilities exist for supplying the "Steel of the Party" metallurgical combine with olivines to be used as raw materials. The improvement of geological expeditions in new regions such as the Gramsh and Sherbenik alps will be valuable in this regard.

Up to the present, some solid ores have been somewhat ignored by the petroleum geological service and the signs of their appearance have not been properly evaluated. Cooperation and coordination of work is necessary for the good progress of geological prospecting work in these and other areas.

CSO: 2102/9

ROLE OF OFFICE FOR STANDARDIZATION, MEASUREMENT IN AIDING ECONOMY

Prague CESKOSLOVENSKA STANDARDIZACE in Czech No 2, 1982 pp 47-49

[Article by Eng Miroslav Vytrens, CSc, Office for Standardization and Measurement, Prague: "The Participation and Role of the Office for Standardization and Measurement Toward Improving the Planned Management System of the National Economy After 1980"]

[Text] The quality of Czechoslovak products has been a critical problem of the Czechoslovak economy for several years and one of the determining conditions for meeting the program of the 16th CPCZ Congress—maintaining and improving the standard of living attained by our population and developing its social security consistent with the expansion of the national economy. The conclusions of the 16th CPCZ Congress emphasized that improvement in the quality and technical standards of products must be given top priority as a condition warranting the expenditure of material resources and human labor.

The Office for Standardization and Measurement [UNM] has an important role in meeting these fundamental objectives of the national economy. Its operation is prescribed by laws on technical standards, measurement services and state testing. The Set of Measures attaches great importance to these technical activities as tools that, through efficient application, can greatly influence the structure of the national economy both by consistently improving product quality and by increasing efficiency of products and consumption.

In the area of technical standardization, the Set of Measures emphasizes that standard-forming activity should be intensively directed toward optimalization of the technical-economic parameters of raw materials and products and toward effecting savings in energy. Maximum efforts should be directed toward international unification of standards, especially in CEMA, which is necessary both for effecting orderly socialist-economic integration and also for the sake of international trade in general, on which the CSSR greatly depends.

In connection with the required goal-oriented program procedures for planning in connection with long-range prospects, it is necessary to apply this principle also to long-range planning for developing technical standards by working out long-range programs for developing the standard base, updating it systematically and forming the conditions for its utilization in the planning process. This calls for eliminating as far as possible the lag between the level of technical standards and technical progress, which still exists in certain cases.

The UNM proceeded conscientiously toward meeting all these requirements even before the Set of Measures had been adopted. A long-range outlook of technical standardization up to the year 1990 had been worked out in connection with the development of individual branches and sectors of the Czechoslovak economy in relation to state goal-oriented programs, the Long-Range Goal-Oriented Program of Cooperation under CEMA, agreements on cooperation and collaboration concluded under CEMA as well as the anticipated development of foreign trade with nonsocialist states. This study is being further elaborated with a time horizon up to the year 2000, with systematic refining it will serve for the preparation of intermediate plans in the area of technical standardization in future 5-year plans.

Standardization activity has a well-defined international character. The development of joint technical standards of CEMA countires is of critical importance. The foundations for this work were laid when the "Statute of CEMA Standards" was approved at the 28th CEMA Congress in 1974 and when the Convention on Application of CEMA Standards was adopted, with ratification by the CSSR the same year. Annual plans for the development of CEMA standards consist of some 2000 standardization subjects, the establishment of which should make a maximum contribution toward developing the socialist integration of the CEMA states. By the end of the first half of last year, 3,108 CEMA standards had been worked out and approved by CEMA authorities. Of these, 2,530 were adopted in the CSSR for use as CEMA standards. The conditions necessary for introducing additional standards are in preparation.

CSSR representatives actively participation in standardization work within the framework of world standardization organizations, the most important being the ISO (International Standards Organization), IEC (International Electrotechnical Commission), EHK/STAND (European Economic Commission's Conference of Governmental Representatives Responsible for Policy in the Field of Standardization), OIML (Organization for Legal Metrology) and several others. In view of the unusually extensive international activity of these standardization organizations and CSSR capabilities, Czechoslovak representatives participate selectively only in those bodies and commissions that have a preferential connection with the needs of the Czechoslovak economy.

The key condition for further development of the Czechoslovak national economy is consistent achievement of substantial savings in raw materials, other materials and energy, both in the production sphere and in consumption. With this in mind, the UNM proceeded toward a systematic checking and

reviewing of all valid Czechoslovak standards. Rigid criteria are applied here, especially with respect to energy and material demands of the products, overall indicators of their quality, reliability, useful life and high efficiency in use. Even though the focus of technical standardization is on material production, great attention and strict measures are applied to the development of standards of a general character, especially those that affect the environment, labor safety and the health protection of our citizens.

In providing measurement services the Set of Measures calls for more activity in production, particularly in key industrial sectors. This is self-evident, because it is practically impossible to envision improving the quality of products during production without systematically redefining and verifying the measured values of the physical quantities by a system of standard measures coordinated with international standard measures. Of course this directly influences both the standardization of the technological production process and the final quality of the product.

The exceptional importance of metrology, however, is apparent not only in the production process; its importance is evident in the measuring and balancing of materials and raw materials, in the consumption of energy of all kinds, since when handling large quantities inaccurate measurements can result in significant material and financial losses. A case in point is measuring the flow of natural gas in transit gaslines, measuring the flow of oil and petroleum products through oil pipelines and product pipelines, etc.

The level of measurement services contains certain deficiencies exhibited both in the management of national metrology and in securing production of the required standard measures as well as in measuring services provided by central bodies in individual branches and sectors. In the interests of greater improvement in national metrology, on 1 January 1981 the UNM proceeded toward a basic reorganizational move by consolidating the entire national metrology into a single unit under the Czechoslovak Metrological Institute in Bratislava. This should function as a research-production unit, working on metrological research projects and performing the practical checking of standard measures as well as securing their production, especially where it is not being provided elsewhere and is difficult to secure in the Czechoslovak industry because of technical demands and the nature of unit production. This concept is contingent upon capital construction by the Czechoslovak Metrological Institute.

The Set of Measures attaches great importance to national testing; this is being performed on the basis of Law No 30/1968 of SBIRKA. A system of 39 state testing stations is operating; 4 are directly subordinate to the UNM and the rest are incorporated within other central bodies and directed by the UNM. In all, these testing stations evaluate more than 30 percent of the voluem of all Czechoslovak production expressed in terms of value.

The Set of Measures calls for increasing the scope of rated products by also involving departmental testing stations and raising the standards of procedures by emphasizing economic criteria, especially export efficiency. Compared with the 1981 plan, the proposal for the Seventh Five-Year Plan calls for a differentiated increase in the capacity of state testing stations by almost 8 percent in 1982, or up to 2.5 million Nh [?standard hours, ratings?]. However, increasing the volume of products rated does not depend solely on extensive development of national testing, the conditions for which are limited, but rather on increasing the efficiency of state testing stations and their management. In this connection the UNM is preparing certain organizational measures, the implementation of which will depend on decisions of the highest party and national bodies. "Main Directions of Economic and Social Development of the CSSR in 1981-85," which characterizes the development of individual branches and sectors, applies also to the material structure of state testing operations. In this connection the nomenclature of products being evaluated by state testing is defined and updated and also the nomenclature of products designated for rating in departmental testing stations, whose operation is in fact only starting up, are also defined in cooperation with appropriate central bodies.

The evaluation of products in state testing stations has consisted mostly of rating technical indicators and comparing them with the technical indicators of similar products of leading world producers. In this regard the performance of state testing stations meets required standards, even though the acquisition of conformable foreign models and technical documentation is often problematical. However, what is really problematical is determining and evaluating objective economic indicators of products, particularly from teh point of view of export efficiency where commercial capabilities of foreign trade are also definitely involved. Certain proposals of economic indicators are being checked out in the practical operations of state testing stations; in the meantime their objectivity does not appear to be clear or realistic. However, these conditions are necessary for evaluating products by state testing stations if we recognize, on the one hand, the appreciable apprehension of producers of inferior products and the considerable markup when products are rated first quality.

The fundamental importance of objective product evaluation also stems from the fact that, beginning with the Seventh Five-Year Plan, a qualitative structure of production and overall volume of products rated as first quality is being planned for the state industrial plan of production and sales. Nonfulfillment of this indicator would indicate nonfulfillment of the state plan by production enterprises, with ensuing appropriate consequences.

Experience has shown that starting product evaluation even in teh preproduction stage can effectively contribute toward obtaining better product quality. This gives the manufacturer the opportunity to eliminate any deficiencies in product quality even before it is put into production. The state testing stations have developed the capacity necessary for this. For the time being, the manufacturer is not obliged to submit his product

in its preproduction stage for evaluation by state testing stations. The importance of this procedure cannot, however, be disputed and so the amendment of UNM Decree No 32/68 of SBIRKA, which is in preparation, makes this procedure mandatory.

An important task assigned by the Set of Measures to the FMTIR [Federal Ministry for Technological and Investment Development], the UNM and central branch authorities, which proceeds from Resolution No 178/77 of the CSSR Government Presidium, is to complete a system of quality management and control in enterprises, VHJs [Economic Production Units] and departments. Within the framework of this task the "Comprehensive Systems of Managing Product Quality" will be introduced or is already in effect in enterprises. This should be superimposed by management systems on the VHJ and production department level and regionally on the state level.

To work on these complicated problems there are specific tasks of the state plan for economic research on which the scientific-technical base of UNM is working. Since broad application is expected in the comprehensive systems of standardization, metrology and state testing stations, the control role of the UNM is being reinforced substantially beyond legal provisions and standards in the areas noted by organizations of the national economy in the form of technical state supervision over standardization. For this purpose, beginning last year, the UNM organized and is gradually setting up regional UNM divisions in Prague, Brno and Bratislava.

The UNM workers realize that successful implementation of the Set of Measures in the Seventh Five-Year Plan will allow raising the efficiency of the Czechoslovak national economy and thereby also secure further improvements in the living standard of our citizens. To this end they, too, want to contribute with all their might.

8491
CSO: 2402/45

PROFITABLE COMPUTER PROGRAM EXPORTS URGED

Prague SVOBODNE SLOVO in Czech 15 May 82 p 3

[Article by Martin Denemark: "Goods of Which One Is Unaware"]

[Text] Computer technology is flooding the world. In Czechoslovakia the number of installed computers of all sizes is rapidly approaching the 3000. To some extent we have not yet become accustomed to computers and are constantly amazed by what these nice "cases" are able to accomplish. Computers truly are able to do many things, but they are entirely dependent on the "intelligence" imparted to them by man. This intelligence is the program that can be defined simply as sequence of orders or instructions that the computer executes.

Programs have deservedly become a significant trade item; incidentally, HOSPODARSKE NOVINY called attention to this fact in its No 7 issue of this year. In many countries there have been formed companies specializing in the writing and sale of separate computer programs. For example, in the independent catalogue "ISIS Software Report", in which various companies advertise, over 4000 programs are listed for West Germany, Austria and Switzerland alone. Sales of separate programs in the United Kingdom exceeded 150 million dollars last year. Moreover, much software is sold together with the hardware, and there are cases when the value of the software exceeds 50 percent of the cost of the entire installation.

Czechoslovakia still has huge reserves in this field. Although the Polytechna Foreign-Trade Enterprise has several tens of programs available for export (in this respect it is beginning to catch up with the number of programs offered by Robotron in the GDR), our export of programs is still in its infancy. But this is entirely understandable, because the situation in export conforms entirely to the state of domestic sales and lists of available programs. And these are essentiall nonexistent.

The situation on our domestic "market" for computer programs is still rather peculiar. It is not possible to set the prices of computer programs simply and unambiguously, and business law lacks provisions according to which enterprises could proceed. If there is any exchange of computer programs at all, it is mostly "illegal" trade, often directly between programmers. Such trading (let us admit that in most cases it is my program in exchange for yours) is still the most simple solution for the time being, but it contains certain risks and does not help to raise the requirements. It is understandable, for example, that the writer of a program will not assume responsibility for its quality and accompanying documentation. Theoretically,

moreover, a programmer could appropriate the work of someone else, while the company would be paying him as if it were his own work.

Of course, the inflexible and imperfect exchange contributes to the problems in recordkeeping. The national organizations for the technical servicing of computers --i.e., Kancelarske Stroje (Business Machines) of Prague, and Datasystem of Bratislava--have a monopoly to some extent on the writing and particularly the adaptation of programs, but so far they lack the capacity to maintain suitable and exhaustive records. They now have on file not quite 300 programs, and they are forced to operate without the benefit of organizational and legal relationships. Therefore their active distribution is very limited and not generally available.

The unfavorable consequences of these problems are very extensive. Our roughly 15,000 programmers are solving at their work places programming tasks that are similar to, or entirely identical with, the tasks being solved by their colleagues. For example, a large number of programs have been written in our country for the computer processing of payrolls or fixed assets. Thus we are wasting, quite unnecessarily, productive and creative capacities. After all, some of our programmers are on the same professional level as their foreign colleagues, and we could export very advantageously their work, or at least the results of their work. Another result of this situation is that top officials at the enterprises are ill-informed. They often are unaware that if their enterprise would offer its programs to Polytechna, it could earn valuable foreign exchange (if the program can be exported, or if it can substitute import).

In recent months, however, work has begun to unfold in our country that aims to gradually alter this unfavorable situation. It is headed primarily by staff members of Polytechna PZO [Foreign-Trade Enterprise]. They are now negotiating with Robotron about issuing joint catalogues of programs, which would be distributed through the regular network of bookstores. General availability of the catalogues would encourage enterprises to publish the results of their work, and thereby to establish contact with Polytechna. Moreover, there would be general awareness of the programs as merchandise.

Simultaneously Polytechna is preparing, for example, comprehensive records of the programs used in health care and geology. Together with the Advanced School of Economics in Prague, it will collect all the programs available for Wang computers that are installed at many of our enterprises. Polytechna wants to offer these programs directly to the company or to foreign users of its computers. Cooperation is being expanded gradually also with the Federal Statistical Office, with which Polytechna is cataloguing certain other programs, according to various aspects. The Federal Ministry for Technical and Investment Development also is filling a gap, by compiling a list of the programs used in planning and design.

The purpose of the present efforts is not only to prepare export quotes, but also to map what Czechoslovakia has done so far in the area of programming. Records of high quality will help to curtail certain unnecessary imports, will eliminate the duplication of some programming effort, and will contribute toward expanding our export of separate programs. This will be of great importance primarily in export, because separately offered programs are more readily marketable (especially in the capitalist countries) than our computer hardware, which for the time being lags behind the top world level.

1014
CSO: 2402/53

BRIEFS

RESEARCH IN ENZYMOLOGY--The national protein program is aimed at expanding the protein base in human and animal nutrition. Consequently greater attention is being paid to proteins including enzymes at such research centers as the Budapest Institute of Enzymology of the Szeged Biological Center. In response to question, Academician Bruno F. Straub who has been director of the Institute since 1971 said the following: "Initially, we are investigating isolated enzymes. Later research switched to study of protein relation within the living cell, enzyme interaction. At the same time, one group is successfully investigating plasmin enzymes which dissolve blood clots. We have evolved a new analytical method for determining the individual components of proteins. Through this, the nutritional value of fodder can be established rapidly. Hogs raised on fodder prepared with our patented procedure for treating soya gain optimal weight on much less food." More and more theoretical research institutes are earning a substantial part of their operating funds directly through undertaking practical work on a contractual basis. The institute of enzymology is no exception according to Straub. However, he feels it would be self deluding to consider this an unequivocally good practice." Basic research is the primary goal of an academic research institute. There would be no future without it. Of course, basic research cannot be planned "without reference to social need. Therefore we now wish to contribute to the scientific bases of agriculture." [Budapest MAGYAR HIRLAP in Hungarian 21 May 82 p 5]

CSO: 2502/82 END

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COMPUTER SYSTEMS DEVELOPMENT OUTLINED

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 1 1982 pp 3-7

[Article by Eng Ivan Malec, Federal Ministry of the Electrotechnical Industry: "Development of Computer Systems and Implementation of Automated Systems of Management"; portions within slantlines in boldface]

[Text] Historical Abstract

An analysis of the state and utilization of computer technology in the national economy for the year 1971, published in 1972 by the Federal Bureau of Statistics, states on p 7 that the first four computers in the CSSR were installed in 1960 (classified in the category of "small" computers). The first generation of computers still could not be efficiently used for automation of management processes. The design of computers of that generation was adapted primarily to handling scientific and technical calculations (among the first computers installed in the CSSR were ZUSE computers, whose designer, Mr Zuse, was himself a civil engineer and designed them primarily for handling static calculations) and, as it soon turned out, they lacked external memories with direct access. For that reason, soon the worldwide trend became development of computers of the second generation, the design of which already made it suited for so-called "mass data processing" and came equipped with disk memories (e.g., the IBM 1410 computer supplied in 1967 for the Office Machinery--Inorga enterprise). Thus, the design for "mass data processing" was technically more demanding. It must be stated, however, that /development of disk memories in the subsequent years in capitalist countries kept pace with the capacity of the systems and that users in the West did not perceive equipping computers with those types of memory as a problem. In the CSSR, deliveries of disk memories are still a limiting factor for development of computer technology applications, particularly applications for purposes of management/ (limitations in importation of large-capacity and even medium-capacity disk units from Bulgaria, e.g., limits in the Seventh Five-Year Plan production of our JSEP [Uniform System of Electronic Computers] systems and deliveries of the SMEP [System of Small Electronic Computers] systems, especially since NATO countries also included limitation of disk capacities into their licensing conditions).

The problems of implementation of automated systems of management became topical in connection with comprehensive overhaul of the automobile plant in

Mlada Boleslav. At that time, the world's automobile industry still stood at the head of computer applications--technically and methodologically. It pioneered the way for new systems of semiautomated data acquisition and distribution, as well as for systems for their processing. For all practical purposes, the most efficient user systems were installed in the automobile industry. An impetus for control and legislative regulation of the implementation of automated systems of management was provided by some personnel of the then Projekta and Kovotechna plants. The proposed topic was then taken up through the initiative of the then State Commission for Management and Organization at the Presidium of the CSSR Government. The fact that the impetus originated from Projekta, i.e., a civil engineering technological design and planning institute, left its mark also on the orientation of how it was dealt with: /the concept was taken up as a part of an amendatory decree regarding design and planning documentation of construction projects/ (obviously justified for two reasons: on the one hand, due to increasing demand for capital investments and, on the other hand, due to direct dependency of operational management on the installed technology; in the above-mentioned automobile plant, considerations regarding automation of management led to considerable demand for investments, i.e., up to 15 percent of total expenditures).

Successful dealing with and solving the problem in the above-described manner, i.e., tying in implementation of automated systems of management with construction of new and comprehensive overhaul of extant plants encountered two obstacles in the mid-sixties: a) Inclusion of management automation projects into the preliminary design and planning process meant conceding the need for further prolongation of the time required for project documentation, which at the then sharp criticism of the excessive number of unfinished units under construction (which is still raised today, among others) was not politically acceptable; b) Inclusion of management projects delivery as an obligation meant conceding the increased laboriousness of projects and undertaking an adaptation of the JCPP (uniform schedule of prices for project operations) which was then recently agreed upon and published and on which all planning activities were based. (A contributory factor to a certain extent was also the fact that planning of management systems was a new planning discipline without tradition and experience, in which final documentation processing still could not avail itself of efficiency promotion measures, so that the relative labor intensity of this part of projects would be disproportionately higher than the laboriousness of the remaining components of construction project planning). /Therefore, organized implementation of automated systems of management failed to materialize on that basis./

During the years of crisis toward the end of the sixties the whole set of problems received only little attention due to underestimation of the role of the plan, central management and emphasis on the self-regulatory role of the free market. Revisionist theories were based on misgivings regarding the possibility of overcoming economic problems by systematic application of the system of management and failed to recognize the value of computer technology as an effective tool to that end. /A new impetus toward implementation of automated systems of management did not come until the transition between the sixties and the seventies provided by Inorga on the basis of the results

of direct scientific and technical cooperation with Soviet partners./ At that time, implementation of automated systems of management in the Soviet Union was promulgated and controlled as a state program with institutional and logistical support. As a result, in 1973 the Federal Ministry for Technical and Investment Development published under Ref No 14243/73 the first methodical guidelines for development of ASRP [automated system of plant management] and, gradually, in subsequent years, also for other levels of management. The program for development of ASR [automated system of management], which in that manner started to take shape slowly but surely, was reinforced in 1973 by promulgation of a balanced system of computers and by applying control restrictions on imports from capitalist countries, when it was stipulated that all demands for computers must be documented by approval of the projected task. Work on a more thorough version of methodical guidelines for implementation of automated systems of management has been carried on since 1976. Nevertheless, it ought to be pointed out that the methodology for implementation of automated systems of management is not tied in directly with procedures prescribed in the area of capital investment, and also that institutional management and control in this area exceeds the capacity and jurisdiction of capital investment control. (Control takes the form of consultations through the system for administration of state and departmental tasks, via the UVVTR [Research and Technological Development Center] and sectorial centers for ASR, even if a more direct approach would obviously help improve the quality of management in this area.)

/Development of automated systems of management in the Sixth Five-Year Plan has already acquired the status of a state program and the plan pursues the objective of tying it in with the state plan at least through balancing computer inventory./

Current State

According to the "Report on the State and Utilization of Computer Technology in the CSSR for the Year 1980" published last year by the Federal Bureau of Statistics, as of 31 December 1980 the inventory of the entire national economy included 1,457 digital computers, 171 punch-card computers, 205 control computers, 434 analog computers and 7 hybrid systems. The increase in the number of computer installations in a rough outline for the fifth and sixth five-year plans is illustrated in the following table:

Dynamics of Computer Installation Growth in the CSSR in 1971-1980

Computer Category	Number of installations as of 31 Dec 1971 in %	Number of installations as of 31 Dec 1980 in %	Index yr 80:71
Digital	64.3	79.5	536
Punch-card	32.6	9.3	124
Control	3.1	11.2	1,577

In the course of the Sixth Five-Year Plan the number of computer installations increased to 167 percent, which means that the rate of increase in installations dropped in comparison to the period of the Fifth Five-Year Plan. /Data

on increases in capacity are not available, even though the importance of this indicator is sure to gradually grow in comparison to the number of installations index, particularly since a major part of computer systems is slated for modernization./

In the course of the Seventh Five-Year Plan it is envisioned to procure 494 JSEP computers (including their importation) and approximately 1,100 SMEP computers (imports not contemplated) for implementation of ASR. The current methodology of planning does not permit an educated estimate as to the numbers of computers to be imported from capitalist countries. Of the currently installed computers, 21.6 percent were imported from the West, which in financial terms does represent a somewhat higher share. Nevertheless, it can be assumed that in the Seventh Five-Year Plan preference will be given to importation of components rather than importation of complete systems. The principle for preference of fewer but better equipped systems has already taken root. (This is borne out, among others, also by the statement emphasized in the preceding paragraph.)

It can be anticipated that the new types of computers which are to be supplied to our users as part of the JSEP and SMEP programs will have performance characteristics which will make it possible, on the one hand, that they find wider application in the area of controlling technological processes and, on the other hand, that they promote the buildup of hierarchically connected systems. Their equipment with graphic display units will also facilitate their use in civil engineering operations. (However, the prerequisite for this is solution of the protracted problems with disks.) /Thus, there will also be a substantial increase in the spectrum of applications in ASR and will bring closer to realization considerations regarding implementation of regional information systems on the territorial principle/ (e.g., systems SEI, AFIS [expansions unknown], etc.) /and their connection to hierarchical systems built up on an organizational principle/--particularly to hierarchical systems of the medium link of management (particularly topical for the trust form). Implementation of systems on a sectorial principle is, for the time being, complicated by inadequate delineation of boundaries among them and their mobility. It can be stated that /the coming generation of JSEP and SMEP computers provides the possibility of connecting them not only into the process of data processing for management, but also into the information exchange process./

Making full use of the current potentials offered by computers is limited on the one hand by the still lagging procurement of disk units and, on the other hand, by the capability of users for interactive operation with them. With the ever-increasing capacity of computer systems and growth in the number of their installations, in the coming years it will be necessary to expand their base of software and its generation, i.e., transfer a substantial part of this effort from programming specialists to qualified users. Herein we must follow not only the path of creating reproducible algorithmic modules, but also the path of creating conditions for controlled compilation of programs (via the display unit of the terminal and by means of programming tools of the type editor, program generator, etc.). Program libraries traditionally have at their disposal reproducible modules of algorithms for various mathematical methods. The current capacity of computers handle even complicated

calculations based on these methods without any problems. Thus, their application in ASR is limited by methodical problems, i.e., the capability of users to make effective use of them in analysis of phenomena and in decision-making processes. Wider use of graphic representation of data is another area that must be utilized more by users. The immediate result is saving of tons of paper.

Microelectronics further promotes those properties of computer systems that are oriented toward further substantial widening of the base of their applications in management; on the one hand, by miniaturization which does away with structural and energy problems which were an accompanying problem of computer use and, on the other hand, improved adaptability due to configuration by transforming current computer components into compact parts, and also by further increases in capacity, all of these with a positive economic impact in both the production and the user sphere.

Introduction of computer systems into the national economy is not regulated by the plan, it is merely limited by economic tools. No priorities have been set in regards to gradual vertical and horizontal interconnection of systems. That means that imported computers are obtained by enterprises that do final processing of goods for exports, financially strong organizations and such, regardless of whether, from the viewpoint of the needs of the national economy, it involves a vital enterprise and, to a certain extent, without regard to the ultimate impact. The concept of implementation of automated systems of management for the years 1981 through 1985 is shown in the following outline of departmental intents in regard to implementation of ASR at individual levels:

ASR Category	Implemented earlier in %	Implemented in 7th FYP in %	Total in %
ASR of production	7.3	1.5	3.3
ASR of medium level	7.4	1.8	5.5
ASR of enterprises	77.6	44.1	66.1
ASR of technological processes	10.7	52.6	25.1
ASR total	100 [sic]	100	100

The balance and concept for production of computer technology in the Seventh Five-Year Plan are essentially based on the assumption that ASR for the above-listed departmental intents will be met for the most part by a single computer system. However, the balance and concept of computer technology production for the Seventh Five-Year Plan do not precisely reflect the demand for modernization of computer systems. Technical equipment by external disk memories forms an exception. There is a consensus that users' needs cannot be met by memory capacities included in the so-called "basic configurations" (i.e., for computers EC 1025 2x100 MB disks, for computers SMEP only 1 to 2 casette disks). /Whether the intents for implementation of ASR in the Seventh Five-Year Plan are covered by design capacities has not been verified./

From the structure of departmental intents it follows that the focus of ASR implementation consists in implementation of ASR of enterprises and ASR of

technological processes. /Departmental intents obviously do not reflect the new role of the medium level of management/, particularly the new role of concerns.

The problems of automation of construction operations also, for all practical purposes, are not reflected in departmental intents. (Concerns take over, e.g., the role of the basic accounting unit--for example, Prum accounting records are kept by concerns and not by the concerns' organizations, several other economic activities and functions of organizations are being concentrated into the concerns as well, which underlines the need for implementation of ASR in them.) It further follows from the structure of departmental intents that only part of the contemplated production of SMEP computers in the amount of 1,100 units in the Seventh Five-Year Plan will be used in the area of ASR of technological processes and that the difference, i.e., approximately 600 computers of this series will have to be used in support of implementation of ASR of enterprises. Of course, that means a new concept of their "basic configuration," particularly as regards their equipment with medium-capacity disk units.

The current activities of institutions authorized to direct implementation of ASR are oriented primarily toward devising of standardized procedures and unification of efforts. They are not directed toward promoting efficiency in system design. These institutions are not adequately equipped to handle the latter task for the time being. /At departmental level, the function of "sectorial center for ASR" was delegated for the most part to various institutions and organizations as another associated function./

Conclusions

A considerably extensive program of implementation of ASR was launched in the CSSR during the Sixth Five-Year Plan. It will be further expanded in the Seventh Five-Year Plan. The technical means for this program are for the most part already provided from the production of socialist countries. Its backup by design capacities has not been verified. For the time being, the program is not oriented toward integration of the ASR being implemented. The activities planned in this area are already backed up by an innovated generation of methodical and normative documentation, but pressure on efficiency in systems design is lacking.

8204
CSO: 2402/50

BRIEFS

INTERNATIONAL SESSION ENDS--The 18th Session of the Council of Plenipotentiaries of the CEMA's Interretalonpribor Scientific-Production Association, attended by representatives of meteorological stations from Bulgaria, Cuba, Hungary, the GDR, Poland, Romania, the USSR and CSSR, ended on 21 May in Bratislava with the signing of a protocol. The session discussed possibilities for further expanding mutual cooperation in research, development and production of standardized precision equipment for measuring various quantities. [Prague RUDE PRAVO in Czech 22 May 82 p 2 AU]

CSO: 2402/56

INSTALLATION OF MORE MINICOMPUTERS URGED

Budapest HETI VILAGGAZDASAG in Hungarian 5 May 82 p 11

[Article by Otto Lendvai: "From Its Head on Its Feet"]

> [Text] Our series on microelectronics inspired Otto Lendvai, department head of the National Nuclear Energy Committee, to write to us. In this article, we pass on to the readers his letter sent to our editorial office.

The mass appearance of minicomputers on the markets of capitalistic countries created a qualitatively new situation. The operating memory and speed of such a computer is greater than those of a computer regarded as a large in the middle of the 1960's by domestic standards. Just using the softward packages which can be ordered along with the system, we can perform complicated computations from bookkeeping to personnel record keeping and documentation. The machine can be connected as a terminal to some large data bank during its idle period. The machine can be used in the autonomous mode whenever needed. It does not depend on the operating schedule of a central machine. It does not depend on a data transfer infrastructure, which is extremely backward and unreliable in our country. It would take a monstrous economical effort to make this network satisfy the complete data transfer of centralized computer systems.

Based on the "mysterious" activities of certain people, the computer becomes a real typewriter, telephone or automobile. Be the language used BASIC or PASCAL or even higher level one, the small machines are directly used by those who had the trouble of having to do without them in the past. And they program them more ane more themselves (or adapt the programs chosen by them). This touches the lives of hundreds of thousands or millions. There is an alarm in the capitalist countries: the machines will displace the people. Should we also be afraid? Not at all, since t has been discovered that computers used in management and data processing hardly displace any of the work force, but rather improve managerial efficiency. If there is anything we need at all, we definitely need that! And if we have anything to fear, we should fear the lack of that.

In Hungary, the way to the future is still visualized through the development of large data networks. Let us ignore the expenses of the mentioned infrastructure for a moment; the matter is also irrational because most of the capcity of a computer performing several parallel tasks is taken up by "housekeeping" tasks: the separate running of the various tasks, the separation of their data and even the proper billing of computer time.

The program systems of large computers are complicated and difficult to learn precisely because of these requirements. The programmer following his own ideas is placed between the user and the performance of the task. If some of the basic ideas of the program turn out to be faulty during implementation, it becomes extremely difficult to correct the fault; under any circumstances, more difficult than when the programs are structured in blocks that are better adapted to the memories of smaller machines. The preparation and testing of large programs takes much more time than those of program segments.

The individually owned small machine not only makes the performance of the work faster. Even a smaller and slower machine is faster if one does not have to wait for a line or for the night-time processing of data and to find out about errors until the next day. The machine waiting for work attracts smart people in contrast to the network where every minute must be paid for--machine use and line use. Direct access to the machine makes one disciplined and demanding. But this is not the case when one has to deal with a "stupid computer center" which cannot do anything with the inaccurate data submitted.

Do not misunderstand me: I have no objection to large machines and the appropriate processing networks! But trains are one thing, and cars another. While "mass motorization" is under way elsewhere in the world, in our country, we are involved with the exclusive building of "railroads." "We", i.e., technical experts involved with the national computer technology, who fundamentally influence higher level economical decisions. And the national electronics industry.

I do not deny it, it is possible that our regulatory system places the industrial companies in jeopardy in this area. The national industry charges well over a million for a system (with one and a half year delivery time) which is retailed over the counter by companies in the west for 5500 dollars, complete with softward and at dropping prices. The national industry turns out a dozen of these, while capitalistic companies mass-produce them turning out 10,000 per one month. While in our country, companies are becoming more often capable of holding the price of four-operation pocket calculators at 8500 forints, they blocked the smuggling of machines sold in the west for one or two dozen dollars with "swords of flame" at our borders.

One of the key questions of the truly troubling problem is this: across the border, work is done using these tools, while we are continuing to use the old methods. In my subjective opinion, relatively speaking we are farther behind now than we were ten years ago--and the disadvantage is increasing.

The concrete suggestion: in order to participate in a data processing network, the user needs a terminal. A decent modern terminal is hardly different from a small computer. Let us put the order of things from its head on its feet! According to the current concept, the way to the expansion of the user circle is: one (or more) terminal per user, a computer center and a data transfer network. We have little money and the pace is slow. Let us take the following path instead: one (or more) microcomputer per user--this way the user circle can be expanded much quicker. And later on the small autonomous machines can be expanded much quicker. And later on the small autonomous machines can be used as the terminals of the large data processing networks! But to achieve this, industry must be made interested, and our import policies must be shaped accordingly.

9901
CSO: 2502/75

NEW DATA PREPARING SYSTEM: ORDAS-ORION

Budapest SZAMITASTECHNIKA in Hungarian Feb 82 p 5

[Article: "ORDAS-ORION DATA SYSTEM"]

[Text] Recently several articles have been dealing with the national situation of data preparation and the plant organizational and hardware and software problems connected with it in the columns of SZAMITASTECHNIKA. These articles revealed the problems of large-service computer centers--SZUV, FUTI--but everyone attempting or forced to handle bookkeeping tasks in his company using his own computer is faced with the same scope of problems. With the decreasing of computer hardware prices today this is possible not only for large enterprises but medium-size and small companies, production and industrial cooperatives and small service companies as well.

Since our company, the ORION Radio and Electronics Enterprise, has been processing commercial orders and production preparation with its own computer for several years, the design used by us may be of general interest in our opinion. Not only because in the present situation this can be considered optimal for small and medium-size companies, but also because (being primarily a manufacturing enterprise) we have developed the data preparing portion of the system in a marketable form bearing the name ORDAS-ORION and exhibited it at the 1981 spring Budapest International Fair.

The production preparation of ORION has been based on small computers (the TPA/i machines of KFKI) right from the outset. In the beginning, we were using one computer, now two and the multiprocessor system developed by their connection. The conventional data input of TPA machines was accomplished via a console in the case of small amount of data, and via punched tape in the case of large amount of data. Thus, in the beginning, data preparation, i.e., the conversion of data into a machine-readable form, the preparation of punched tapes from the numeric and character certificates was done via teletypes. This design, however, had to be soon "bailed out" by more modern data preparation. This had ergonomic (noise: ear damage) and technical and economic reasons. The error rate of electromechanical devices is high; the checking and correction of punched tapes is difficult. Since it cannot be done visually, it takes advantage of the computer and must be handled with care (is easily torn). Furthermore, with time, the electromechanical devices became used up, their maintenance costs quickly increased, and the continuous provision of data preparation was causing more and more problems.

The application of screen devices manufactured in-house offered the obvious solution for data preparation. At the time, the common characteristic of the screen data preparation systems, so-called key-to-disc systems, appearing in the west was that the character by character treatment of the data, resulting from the use of the simple displays, put an extreme load on the computer. In the beginning, we connected an in-house manufactured ESZR terminal (ESZ 8564), much more "intelligent" than the aforementioned displays, to the TPA/i minicomputer. This terminal made the screen units independent from the computer, and relieved the machine from controlling the screens. This, of course, was a redundant design, since a significant part of the capabilities of the terminal developed for a large computer was not necessary in this application, but the system developed in this manner satisfied our in-house requirements and offered the opportunity to develop an effective software. Even at this stage of the development, the idea came up that it would be worthwhile to develop a product from this system. Thus we developed a group screen control unit which can be built into the computer, instead of developing a terminal control unit. This unit functions based on a M 6800 microprocessor and acts as a concentrator.

Next, let us review the services and structures of ORDAS.

ORDAS is an 8-work station key-to-disc organization data preparing system. The work stations are CRT screens with alphanumeric and numeric keyboards. The data recorder at the work stations performs the following tasks: data input, data checking (verification), correction, modification.

DATA INPUT

The 8-data-input terminals available in the system offer the possibility of the simultaneous entering of data according to eight different formats. Naturally, any of the available operating modes (data input, checking, correction, modification) can be simultaneously activated on the individual screens.

The data input mode offers the possibility of creating new data files and the expansion of the already existing data files.

CHECKING

This assures the rerecording of the records of the already existing data file according to the format. It compares the actual record contents to the contents displayed on the screen and sets the error bit in case of divergence.

CORRECTION

Based on the contents of the indicator bit assigned to the records of the data files, this operating mode searches for the faulty data records, corrects them and reenters them into the data files.

MODIFICATION

This operating mode searches for any desired record of the data file, changes it and reenters it into the data files, independent of the value of the indicator bit. The removal or editing of records is also possible.

Thus, through the effective use of the services offered by the system, faultless data files can be created on the disc. These files can be used by the user in several ways:

--in the case of smaller files, the system can process them as a stand-alone computer;

--the system can provide an off-line connection to a large computer by recording the data in IBM/ESZR and DEC/MSZR compatible format onto magnetic tape;

--by an on-line connection, via a modem, the system can be connected to another computer which performs the final processing of the data.

(The structure of this goal system is shown in the figure.)

Individual hardware elements:

--CPU: TPA-L 12-bit microprocessor computer;

--operating memory: 32 K words;

--background storage: 1 cartridge disc unit, with a fixed and a replaceable disc (7 M word capacity), 1 DISCMOM fixed drive magnetic disc storage (256 M word capacity);

--consoles: ADP-2000 alphanumeric screen unit 24 lines X 80 characters screen format;

--hard copy: DZM-180 (or Robotron 1156) dot matrix printer;

--data recording work stations: 8 ADP-2001 alphanumeric screen units with an 84 X 80 character screen capacity, with numeric and alphanumeric keyboards;

--optional units; background storage: 1 or 2 magnetic tape units, ESZR-MSZR compatible; on-line connection: synchronous or asynchronous line transmission, up to a 9,600 bits/s rate; modems; AM-1201, AM-12TD, 1,200 bits/s.

Software elements of the system:

--OS/i general-purpose operating system,
--OS/i editor programs (editor, etc.),
--OS/i FORTRAN-II, high level programming language,
--MIDIBOL, SORT, SELECT bookkeeping-oriented programming language,
--RTS/i real-time operating system,
--ORDAS program package, oriented toward data preparation.

What are the advantages that make this system the optimal design for small and medium-size companies?

Data preparation takes up 20-25 percent of the capacity of the central unit. At the time of the data preparation, with the remaining 75-80 percent, the configuration can be used as a general-purpose computer with certain limitations, in the OS/i operating system. When there is no data preparation, the

system can be used as a general-purpose small computer within the limitations of the hardware which however, can be expanded (replace the dot matrix printer with a line printer, for instance).

The flexible handling of data is greatly enhanced by their two-fold formatting: independent input and output formats.

It takes maximum advantage of the autonomous features (independent storage, text editing, protected fields) of the ORION ADP-2001 CRT alphanumeric screen units, and thus relieves the computer.

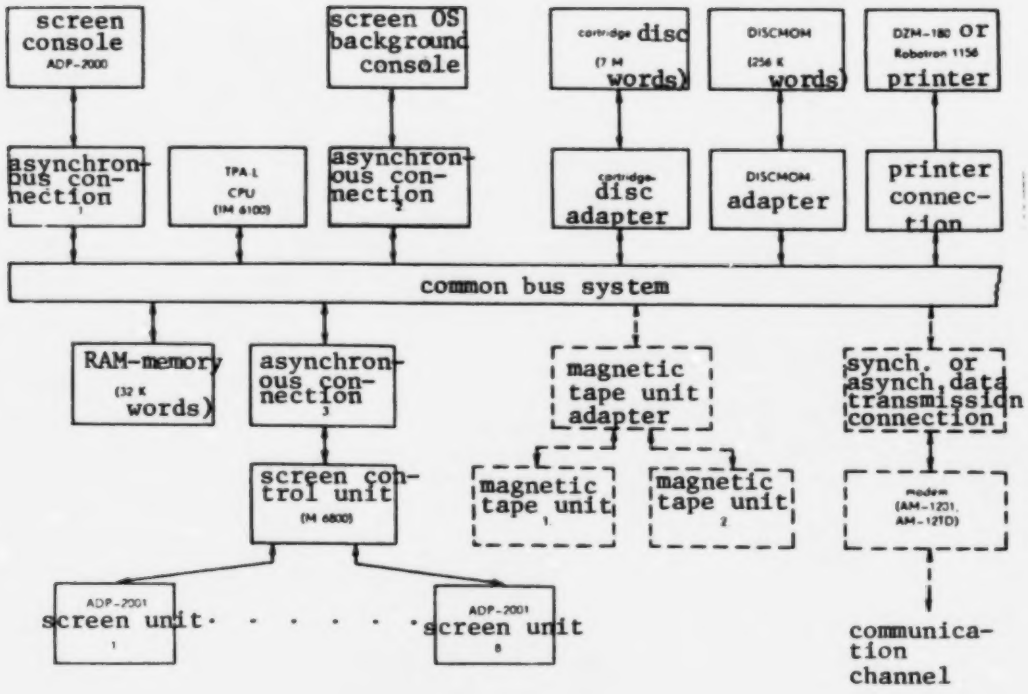
To protect against power failures or similar faults, the system protects the data files in such a way that at most 5-minutes worth of data-preparation data are lost during such emergencies.

The configuration of the system permits the positioning of screen units within a 1,000-meter distance. Thus distributed processing tasks can also be implemented.

--With the help of the on-line connection, the ORDAS system can also be used as the satellite subsystem of a large computer. The hardware configuration permits both synchronous and asynchronous connections. The hardware required for this can be optionally shipped with the system. The software necessary for the connection has not been created, because this must be configured according to the needs and capacities of the users (according to the type of the machine performing the further processing)--we are willing to accept responsibility for its development on a case-by-case basis.

The other significant relationship has to do with the optional magnetic tape unit. In our present system, we are using ZMB 51 magnetic tape devices manufacutred in the GDR, but these can no longer be regarded as state of the art. KFKI developed the MSX model magnetic tape device which has excellent features. This device will be manufactured by ORION; it can, of course, be ordered independent of the ORDAS system.

Those wishing to become more familiar with the system or observe it in operation for the purpose of gaining preliminary technical information can get in touch with the factory computer center.



ORDAS-ORION Data Preparing System

9901
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TECHNICAL-ECONOMIC COMPARISON OF MULTIPLEXORS

Budapest SZAMITASTECHNIKA in Hungarian Feb 82 p 4

[Article by Janos Sved: "Technical-Economic Comparison of Multiplexors"]

[Text] Finally the Hungarian remote data processing (TAF) user--or rather future user--reached the stage where instead of having to cope with the shortages which characterized the 1970's, he is offered some choices. In this article, based on technical-economic considerations, we should like to assist him in making a choice. The article examines exclusively multiplexors available in Hungary and in the socialist countries and which are stocked in our country. Even from these, we shall concentrate on those which are either already operating in some installations or are included in the purchasing plan of SZAMALK. Thus we shall not deal with IBM multiplexors and communications drivers 3704 and 3705, since there are examples for the connection of the IBM machine and the Hungarian multiplexor. We shall not deal with the Bulgarian MPD-1 (ESZ 8401) and the MPD-4 (ESZ 8403) GDR-made multiplexors which, according to our knowledge, are not included in the long-range plans, although there is one or two of these in the country. We shall only briefly mention the ESZ 1010 based Videoton multiplexor, which is known by the trade name VT 55000. The production of this has been canceled with the cancellation of the production of the ESZ 1010. The configurations in Hungary have significant differences, and thus comparisons with other multiplexors are difficult.

We shall deal with three devices in detail: the MPMX-51 multiplexor developed by SZKI, the Polish ESZ 8371.01 device and the TMX 2410 (ESZ 8410) of the Telephone Factory.

SZKI designed its multiplexor to alleviate a shortage and wishes to produce a total of 15 of them. It completed production by 1981 and forwarded the further requests to the Telephone Factory.

The SZKI multiplexor can serve a maximum of 16 lines, from which a maximum of 4 can be synchronous. On the synchronous line, it handles IBM BSC, on the asynchronous, IBM 2740 procedure. The device can be connected only to one computer; it does not have a two-channel switch. Its price varies (depending on the expansion) between 2 and 3 million forints. The expenses of the installation to the software environment must be added to this; this is also handled by SZKI. The guaranteed servicing of the device is also performed by SZKI.

The ESZ 8371.01 designation device which is the backbone of the Polish Tele JS and is equivalent to the IBM 3705 is distributed by SZAMALK. This network controlling processor emulates conventional multiplexors (IBM 270X); in addition it can be used in a network controller operating mode (using IBM terminology, via an NCP program).

The device installed by OSZV (its legal successor is SZAMALK) is currently used in the emulator operating mode, in the ESZ 1055 environment. The network controller program will be shipped by the Poles in the near future; in addition, SZAMALK is making an effort to install the NCP with an expansion of the operating storage to 256 kbytes, using a nationally developed semiconductor storage.

The 8371.01 network controller processor can serve a maximum of 352 lines, with the aid of SS, BSC/SDLC line protocols in the 50-39,000 bps transmission range.

The equipment is recommended primarily to users having larger central resources (mostly users of the second series ESZR systems 1035, 1055) and desiring to operate a large capacity terminal network with a multiplexor, network controller or a combination thereof. In these applications, of course, the presence of access methods (TCAM, VTAM) providing a connection with the network is required in the operating system and the activation of dialog (TSO) systems and that of TAF monitors (CICS, SHADOWS, etc.).

TERTA started the production of the TMX 2410 multiplexor. (The device was introduced in the November 1980 issue of our magazine.--The Editors.)

So far, we have produced about 60 of them; most of these were exported. Until now, six have been installed in our country with various ESZR and IBM 370 computers. The terminals served include the IBM 3270, the ORION AP-62, 64, the Videoton VTS 56100, VDT 52104, the TERTA TAP-2, TAP-70 and TAP-34 and the Polish ESZ 7910 terminals.

The price of the basic configuration of the system is 876,000 forints for 1 line. The basic configuration can be expanded to 32 lines; the price of the expansion is 24,000 forints/line. Terminals with various algorithm and speed can be combined in the configuration. TERTA also takes care of the installation of the TAF subsystem, which works together with the multiplexor, to the software environment required by the user.

Some Data of Multiplexors

Type of Multiplexor	MPMS 51	TELE JS ESZ 8371.01	TMX 2410 (ESZ 8410)
minimum number of lines	16	(64) 352	32
types of terminals saved	IBM BSC (on a maximum of 4 lines)	IBM BSC elements of the ESZ 7900 terminal family	IBM and ESZR BSC
	VT 340 (as an IBM 2740)	ESZ 8575	TAP-2 TAP-3 TAP-70 TAP-34 AP-62 AP-64 teletypes
price of a minimum configuration (in forints)	2 million	3.7 million	0.9 million

9901
CSO: 2502/77

R&D TASKS OF COMPUTER NETWORKS

Budapest SZAMITASTECHNIKA in Hungarian Feb 82 p 3

[Article by L. CS.: "R&D Tasks of Computer Network Systems"]

[Excerpt] Network goal task 51 involves the national development and introduction of a new remote data processing system and device generation.

We shall describe the main research program to be implemented during the Sixth Five-Year Plan within the framework of SZKCP goal task 51.

The tasks can be divided into five groups related on several points.

--The problem of the public postal data network connection. Within this, the primary task is the preparation of the packet-switched service.

--The cooperation in the development of the next remote data processing (TAF) generation of ESZR, whose goal is the development of the open network architecture of a single and multimachine ESZR.

--Network integration of ESZR-MSZR and other computers. By the application of the aforementioned standard concepts, a hardware-software base must be developed, which, based on the postal data network services, allows the development of network sample and user systems consisting of inhomogeneous elements.

--The development of goal-oriented ESZR-MSZR minicomputer networks. Access to the services of large ESZR models via minicomputer networks.

--The development of local networks, access to the services of larger ESZR models via local networks.

Let us assume some of the interesting typical characteristics of these tasks!

As we know, the Hungarian Post opened its new line-switched data transfer network in 1981. Based on international experience, however, the introduction of packet-switched services also appears necessary. Packet-switch network services offer the possibility of handling parallel traffic, the coordination of the activities of computers operating at various speeds and the advantageous development of international network connections. Since network access

protocols are rather complex, prior to the introduction of the postal service, a rather intensive preparatory effort is needed both from the provider and the user of the service.

We are performing these preparatory tasks within the framework of goal task 51.

The preparation of the packet-switched network connection and the performance of traffic experiments is made possible by the packet-switched subnetwork of the MTA computer network.

The ESZR open network system (in its first developmental stage) is developed from a model system containing a processing computer, a Polish ESZ 8371 TAF processor, and an ESZ 1035 computer. This system offers the possibility of the testing and system integration of domestically developed ESZR network architecture terminals and TAF processors. During the implementation of the task, the development of a system containing several computers must also be handled. This can be done in part by implementing the connection to the packet-switched network and in part by the acceptance of the multi-machine ESZR software, i.e., by participating in the development.

The third task group (the development of the know-how of a network consisting of inhomogeneous devices) makes possible the complex network integration of ESZR and other machines which already exist but are incompatible with the ESZR network architecture.

Based on the ESZR-MSZR common network concept of socialist countries, we shall participate in the development of standard architecture and the preparation of the hardware-software implementation during the effort.

The goal is to complete by the end of the Sixth Five-Year Plan the production of a few network systems operating on this principle and to place them in operation.

A part of the requirements presented in the peoples economy is relatively narrow and goal-oriented but requires a complete network service in the given area. Such demands are best met by a network developed from mini- or mega-minicomputers. This approach offers the opportunity of the sensible minimization of the functions of the protocol levels, but at the same time it is necessary to implement all protocol levels needed for the given application. Thus the objective of the task is the establishment of goal-oriented minicomputer networks which satisfy the requirement of a closed user circle (e.g., production management of the enterprise).

The development of local networks in the past 2 years is highly visible.

With the help of the physical connection allowing rapid mass data transfer, the computer resources located at a limited distance can be integrated into a unified network system, a so-called local network.

The primary goal of the development is the creation of a high-speed data network. During the development of the architecture of the local networks, special attention must be paid to the compatibility of the higher level protocols of the systems mentioned earlier and that of the devices used to implement the

prototype. In addition to the integration of the ESZR-MSZR computers, the requirements of the devices needed for office automation must also be satisfied.

It is our hope that even this brief description will be sufficient to provide an overview of the high-volume and multifaceted research activity planned for the period between 1981-1985. Nearly all national institutes involved with this subject participate in this project; the most significant effort is being made by MTA SZTAKI, SZKI, KFKI, SZAMKI (its legal successor: SZAMALK), BME HEI, the Hungarian Post and Videoton.

The research is financed by OMFB, MTA, the Ministry of Industry, the Hungarian Post, KSH and Videoton.

Applications in the peoples economy will be provided by the agreements reached between the developers and the national manufacturers (Videoton, TERTA), moreover OSZV (its legal successor: SAZMALK) which is the primary entrepreneur.

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CSO: 2502/77

REMOTE DATA PROCESSING PROBLEMS EXPLAINED

Budapest HETI VILAGGAZDASAG in Hungarian 5 May 82 p 12

[Article: "GOLEM in Hungary"]

[Text] Life is not easy in Hungary for those technical experts who are involved iwth remote data processing, the development and operation of remote computer networks. Neither software nor hardware conditions are favorable. The domestic telephone network is often incapable of handling simple phone calls, let alone data transmission requiring a much higher level of reliability. Furthermore, the national organizers of micro-electronics are faced with a low level computer culture and a lack of a receptive attitude.

In spite of all of this, a few computer networks are already in operation in Hungary. From the technical viewpoint (by national standards), one of the most modern one of these is DATORG, the network of the Hungarian foreign-trade organizational enterprise. At the present, 40 terminals are connected to it; among them, 18 are located at various sites in the capital (mostly in foreign-trade enterprises), and one temporarily in the Dobogoko Management Training Center.

Foreign trade enterprises, which have DATORG, directly transfer their data to the central foreign-trade data bank and can access information in it at any time. They can take advantage of such systems as the GOLEM textual data-base management system, which is suited among other things for the development of management information systems (based on it, managers can receive up-to-date information on tasks assigned by them earlier) or the preparation of mailing lists and the proper classification of the addresses (HUNGEXPO organizes its exhibitions on a system like this; its own terminal even addresses the envolopes, using the information received from the central machine). Several foreign-trade enterprises, also using the central machine, prepare via remote terminals a price information system for COMECON price negotiations which contains all information necessary for the generation of the price five years back.

According to the experience of DATORG, many foreign-trade companies do not even take advantage of this system which has rather limited technical possibilities compared to the capacity of large computer networks in the west. Although during the past years, even the national industry produced some encouraging results in the production of computers and peripheries which can be also used in remote data processing systems. The video screen terminals of VIDEOTON are suitable for a simpler connection to the large computer; the equipment of Telephone Factory even have their own memory, and thus their intelligence can be shared with the central machine; a magnetic tape memory can also be connected to the equipment of VILATI. The small VIDEOTON computers which can also be used as stand-alone computers fit easily into the remote data processing system.

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BRIEFS

FIRST R-60 COMPUTER OPERATION--A ceremony for officially putting the first R-60 computer into operation in Poland was held at ZETO [Main Center for Electronic Computer Equipment] in Katowice on 2 September 1981. This computer, which is the largest RYAD series model being currently produced, provides the capability of substantially increasing the capacity of the current computer equipment and consequently to increase considerably the computing potential of the Katowice center. The importance of this fact was stressed by the participation in the ceremony of not only high-level representatives of the Ministry of Science, Higher Education and Technology, provincial authorities and major users of ZETO in Katowice but also the representatives of the R-60 producer's higher management, Polish and Soviet branch foreign trade agencies and the commercial department of the Soviet embassy in Poland. [Text] [Warsaw INFORMATYKA in Polish No 1, Jan 82 p 25]

CSO: 2602/20

EMIGRE SOURCE DISCUSSES NUCLEAR ENERGY PROGRAM

Paris BULETIN DE INFORMATIE PENTRU ROMANI IN EXIL in Romanian 1 May 82 p 2

/Article by Grigore Filiti: "Romania's Nuclear Program"/

/Text/ The plans drafted by the RCP Central Committee called for construction of 12 nuclear electric power plants by the year 2000 totaling 10,000 mwe (1 mwe = 1,000 kwe, or kilowatts of real electricity, the installed thermal power being much greater) of the 180,000-200,000 mw entered back in 1973 in the energy program for the last quarter of the century.

Negotiations with Canadian firms specializing in constructions in developing countries led from reduction to reduction to the purchase of only four 660 mwe reactors of the CANDU type, which permit use of the natural uranium available in Romania. The first plant is under construction at Cernavoda, where the Danube will supply the nenecessary cooling water. On 31 March 1982 the Plenum of the Central Committee decided to purchase a fifth reactor for the power plant, which will make it one of the most important nuclear electric plants in the world.

The Romanian government asked an American-Italian consortium to deliver two reactors with an installed power of 700 mwe, the contract amounting to $320 million. These reactors will be installed in a plant in Transylvania similar to the one at Cernavoda, and one or both units are to be placed in operation by 1990.*

On the other hand, within COMECON Romania is contributing to the construction of the Yuzhno-Ukrainsk (formerly Konstantinovka) Nuclear Power Plant and also to the installation of the Soviet-Romanian-Bulgarian high-voltage power line, which will distribute the current produced by that power plant to Romania and Bulgaria.

This kind of cooperation with the USSR is preferred by Ceausescu, under the pretext of the delays in building the power plants in Romania. It results in an even greater economic dependence on the USSR.

The delays are apparent and understandable upon analysis of the difficulties encountered. The CANDU (Canadian Deuterium-Oxide Uranium) channel started in 1967 with one

*A third power plant, located in Moldavia, will be equipped with three 1,000 mwe reactors, one of which will be in operation in 1990.

200 mwe reactor and gave rise to a series of 16 other units of 500-750 mwe capacity in operation in Canada (but also in other, developing countries).

The difficulties presented by the CANDU channel are, first, the price of heavy water (deuterium oxide) used as a moderator and a coolant. One 660 mwe reactor requires 660 tons of heavy water at $100,000 a ton, or $66 million, which is nearly one-third of the total price of the reactor.

In the second place, the container of the core of the reactor has large dimensions, probably 12.50 m high, 16.50 meters in diameter and at least a 10 cm thickness of the steel. The welding of the cylinder and lids is very delicate. The core is inside a biologic case 60 m high, 30 m in diameter and with a 6 m thickness of precompressed barite concrete. And so, in the third place, special foundations are used because the whole unit weighs at least 70,000 tons. Moreover the power plant includes large buildings to house the turbogenerators and the rest of the technical installations, which may be common to several reactors.

The Central Committee's plan called for construction of more reactors when the earthquake occurred in 1978, which caused the Canadians to request installation of antiseismic protection requiring a new and heavy expenditure of more foreign exchange. The consequences of the destruction of a reactor, with insufficient biologic protection for reasons of economy typical of the so-called socialist republics, were considered catastrophic, especially because the prevailing winds blow from Romania toward the USSR. This compelled the reckless RCP Central Committee to plan construction of nuclear power plants only in areas of weak or no seismic activity and to participate in construction of power plants on Soviet territory located on the Podolian plateau (possibly in southern Bessarabia) included in the integrationist plans of COMECON.

Note that only the reactors will resist a powerful earthquake, shifting a few centimeters, and the rest of the installations may be destroyed. A final difficulty with the CANDU channel is the needs for fuel. Every installed mwe requires 500 kg of metal uranium, or 3,850 tons for the present level of 7,700 mwe. The lifetime of a reactor is 30 years, and so the current output of uranium, solely to resupply the power plants scheduled in 1982, is 130 tons, at a price that will rise as the lodes give out. We note that in Romania the uranium output is controlled by a mixed Soviet-Romanian company (SOVROM) and the statistics on it have always been secret.

In comparison with the channels in the West and even in the USSR, those in Romania will already be obsolete by the time they go into operation, since the new channels use enriched uranium and supergenerators that not only consume less fuel but even produce it. The USSR has an enriched unranium plant but it has difficulties with local deliveries. Romania's natural resources will continue to be despoiled.

Installed Power and Electric Power Output in Romania

Year	1970	1982	1990
Population in 1,000's of inhabitants	20,053	22,550	25,000
Annual output in 1000's of mwh			
a. Self-producers		3,800	4,000
b. Plants of Ministry of Electric Power		70,300	106,000
-Hydroelectric power plants	2,773	12,900	26,400
-Power plants burning coals	9,684	24,030	48,400
-Power plants burning hydrocarbons	21,579	31,820	5,000
-Power plants using reusable energy resources and new sources	947	1,550	5,200
-Nuclear power plants			25,000
Total	35,008	74,100	110,000
Per capita annual output in kwh	1,732	3,286	4,400
Per capita installed power in kw	0.363	0.764	1.299
Installed power in electric power plants of Ministry of Electric Power in mw			
-Hydroelectric power plants	1,200	3,861	9,357
-Power plants burning coal and bituminous shales	6,146	7,261	12,500
-Power plants using hydrocarbons, wood, solar and wind power, etc.		6,110	6,110
-Nuclear power plants			4,500
Total	7,364	17,232	32,467
Ratio of output to installed power (hours per year)	4,776	4,300	3,388
Use coefficient of installed power	0.547	0.491	0.386

5186
CSO: 2702/10

POSSIBILITIES OFFERED BY NEW 'INTERCOB' PROGRAM PACKAGE

Bucharest STIINTA SI TEHNICA in Romanian No 12, Dec 81 p 34

/Article by Dr. V. Peteanu/

/Text/ After more than a decade of use of computers in the economy it can be said that the vast majority of economic units in Romania are using automated data processing. But the two main characteristics of the electronic computer, its memory and speed, are only partially exploited because most of the processing is confined to organizing and handling large volumes of data or to making simple, repetitive calculations. Few data processing systems or applications of them employ modern mathematical methods, especially modeling and simulation, although it is modeling that can produce the most spectacular results in economically effective use of computers in the economy. The models, especially the operational research models, appeared at almost the same time as the first computers and still bear the stamp of those beginning years. They have notmade sufficient allowance for the impact of the computer upon economic thinking, they have evolved more slowly than computing equipment, and most of them are not adapted to the possibilities of teleprocessing and conversational operation.

The traditional model contains a great many variables, a set of restrictions, and an end function. An optimal solution is sought, that is the values the variables are to take in order to accomplish the optimal (maximal or minimal) end function while conforming to the restrictions. Such a solution is mathematically perfect but rarely satisfactory in practice.

Of course a model is a more or less approximate representation of a specific problem, and consequently the optimal solution of the model is rarely the best solution of the problem. And in practice an operator (or decider) is actually trying to accomplish several objectives and cannot sacrifice the majority of them in order to rationalize any one. Therefore models with several end functions were developed, and a good solution of the problem is a solution of the model that provides an acceptable compromise among the values of the end function.

The decider must cease to be a spectator provided by a computer with a solution of the model that he will apply as such. Using a computer and a model he, the decider, must construct his solution and must be able to modify it at will (within some objective restrictions of course) and to be a true author of the decision with the aid of

the model and computer. Accordingly the decider must be able to accomplish an intercorrelation of the objectives (INTERCOB) with a minimum knowledge of information science and modeling, and the resulting INTERCOB program, which is actually a package of programs, is an attempt to accomplish those aims.

The first version of the INTERCOB package was produced at the Cluj-Napoca Regional Computer Center in 1981. The package can be used at a distance, meaning that the decider can install a terminal in his office while the computer can even be in another locality.

The package appears at the user's request, i.e. it indicates how it can be used. It requires no knowledge of information science on the user's part and even directs him to improve the solutions in the INTERCOB process. The user establishes the set of objectives in which he is interested, as well as his preferences as to the level of each particular objective.

What happens if the INTERCOB package is used in planning, let us say? To be sure a number of restrictions will be imposed by the production capacities, the minimum quantities of each variety or group of varieties to be produced, the available raw materials and materials, funds, manpower, energy etc. INTERCOB provides a solution but indicates it only upon the user's request. But it does indicate the values of the objectives pursued (as for example the value of the gross output, the value of the net output, the extent of the outlays, productivity, profit etc.) The user can request another solution reflecting preferences as to increasing or reducing the values of some objectives and keeping those of other objectives within certain limits. Of course the value of one objective will generally be improved by a compromise in the way of accepting inferior values for other objectives. INTERCOB calculates a new solution and provides new values for the objectives pursued. If these values are satisfactory the user can request the solution (the production structure). Otherwise he will formulate new requests concerning the objectives and the dialogue will continue. When a solution is obtained that is relatively acceptable but shows minor changes in the value of a given indicator, INTERCOB can supply upon request the list of resources that do not permit the desired change because they are exhausted. In this way the user can determine which resources would have to be supplemented and exactly how far in order to attain the desired value of the respective indicator. After the solution is finalized INTERCOB can supply upon request a list of the resources and the quantities that have not been consumed, and the user can decide upon their use for other purposes. This prevents accumulation of surplus stockpiles in the planning stage. Accordingly the operator has to deal with a small number of values with which he works directly, while the bulk of the information is handled automatically by the electronic computer. He can concentrate upon the major planning problems without bogging down in the mass of information and calculations.

The model can be expanded in progress by adding new resources and also by requesting manufacture of new products or increasing the output volume of certain items. INTERCOB analyzes the possibility of producing the requested new item and the user can start again with INTERCOB on the new terms. This facility commends the INTERCOB package as an excellent tool in contracting operations too, where it must be determined rapidly whether a new order or one supplementing the existing order is acceptable despite its effects upon some of the enterprise's economic indicators.

In order to place the INTERCOB package in operation, two stages must be passed that require a greater effort, namely specific determination of the model (restrictions

and end functions) and feeding the model with data (resources and specific consumption).

These tasks will be performed by a team of specialists in modeling and by the managers in charge of the necessary information.

Although the first version of INTERCOB was made for cases where the restrictions and objectives are linear functions, the package remains "open" in the sense that future versions can also be made that will no longer require linearity and the way the decider uses them will not be changed. Accordingly the decider (usually a manager) will use the next versions in the same way as the present one, and the changes in the model will be made solely by the specialists. The INTERCOB package will be available upon its approval at the end of a testing stage.

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END

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EAST EUROPE REPORT

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GREATER ROLE FOR SCIENTIFIC-TECHNICAL ASSOCIATION FORESEEN

Budapest MUSZAKI ELET in Hungarian 29 Apr 82 pp 1, 3

[Interview with Dr Janos Toth, secretary-general of the Federation of Technical and Scientific Associations by Gyorgy Pongracz; no date or place given]

[Text] Scarcely 2 months have passed since the Council of Ministers' decision that the MTESZ (Federation of Technical and Scientific Associations) will be included institutionally in the preparation and execution of all highly important--that is, forming a part of the economic plan--decisions belonging to the sphere of authority of the members of the ministerial council, the Council of Ministers and government committees. In addition to this decision, which represents a milestone in the life of the MTESZ, there are innumerable signs that the position and role of the Federation in our economy and social life has grown. The new situation, of course, is accompanied by new tasks and increased expectations that can be satisfied by an altered style of work. Gyorgy Pongracz, the chief editor of our newspaper, spoke with Dr Janos Toth about these changes and about the most important tasks of the Federation.

Prior to the decision by the Council of Ministers, the MSZMP Politburo discussed the report on the work of the MTESZ. The recommendation derived from the finding that the economic tasks of the coming period will pose increasingly higher requirements on the intellectuals in the field of economics and agrarian and natural sciences, and will make it necessary to discover intellectual reserves and use these more successfully. Therefore, their initiatives and creative work must be used in a more organized and purposeful way in the mechanism of political and state life, and in the preparation and execution of decisions.

In the realization of this task, an important and responsible role falls to the social organization of so-called practical intellectuals, the Federation of Technical and Scientific Associations and its 32 affiliates.

We Turned to the Government

[Question] Since the decision by the Council of Ministers, what kind of new tasks has the MTESZ leadership dealt with?

[Answer] The enlarged role of the intellectuals in the field of economics and agrarian and natural sciences is having a favorable effect on the creative spirit and action readiness of the Federation. At the same time, contradictions can still be felt between the increased demands and the factors obstructing implementation. We are trying to solve these with our own possibilities. The national presidium of the MTESZ discussed the experiences and lessons of the 13th General Assembly which was held in October of last year. We transmitted the observations and proposals of general interest that were voiced there to Comrade Ferenc Havasi, secretary of the MSZMP Central Committee, and Comrade Gyorgy Lazar, premier of the Council of Ministers. We expressed the desire that requirements of the technical, agrarian and natural scientific experts should be judged in a supportive way--in accordance with their merits and creative work--in the field of various social allotments and preferences, for example, in housing distribution, placements in nurseries and kindergartens, and so forth. We recommended a position which, independently of the present wage categories, would afford opportunities and incentives for outstanding creative work, and for more differentiated and higher material remuneration of producer and organizer work. We requested that they restore the training of technicians in a more modern form than existed previously.

We also turned to the government with several problems of the MTESZ itself. We raised the fact that in respect to financial accounting our activities which serve to disseminate trade information belong to the conceptual sphere of "operational representation"--constrained not only by form but also numerically--has in many cases an inhibiting effect.

We have already received the answer, namely, that the government organs will study the differences evident in social allotments and the possibility of their gradual elimination. They agreed with the need to modernize the training of technicians, and the Ministry of Education was given authority to find a solution. There will be opportunity for the Federation to cooperate in this search and to make recommendations. The premier agreed that there is in fact a need for greater moral and material recognition of creative work, but--as he emphasized--the local economic managers do not even make adequate use of the orders that are currently valid. The work plan of the Ministry of Finance for the first half year already includes a full-scale study of representation regulation. Better care will be taken to see that irrational prescriptions do not obstruct the transmitting of technical-scientific information.

[Question] Is the effect of the enlarged role of the MTESZ evident in relations developed with other leading organs, highest authorities, offices and institutions?

[Answer] Of course. It has had a very positive effect. They ask for and seek our views, recommendations and observations much more than before. Here is one example of how our situation has changed: now almost every ministry and national authority informs us of its annual work plan. The Ministry of Industry has specially asked for an expansion of our cooperation. Our

Federation is participating now in solving many economically important problems. We are trying to see that our members concentrate their intellectual strengths on important problems like, for example, energy management, electronic spare parts manufacture, the basic industry for the food economy, development of the pharmaceutical industry, innovation, environmental protection, the working out and testing of new methods for teaching language, the use and broad-scale circulation of innovations and inventions, or the modernization of the training of technicians.

At the request of the MSZMP Central Committee, we worked out proposals for a concept of public education; and in the spirit of a Council of Ministers' resolution "regarding certain timely tasks related to the Balaton recreation district" the government asked our Federation to work out a long-term development program for collaboration in the development of water management, settlement development, environmental protection, and the Balaton recreation district itself. This year on 11-12 June, under the organization of the SZVT [Scientific Society of Organization and Management] we shall arrange for the second exchange-of-experience conference of economic and personnel managers on the subject of personnel work. Now we are engaged in working out in greater detail our own methods for "opinion research." That is, we want to be able to measure accurately what is the opinion of the practical intellectuals regarding a given question.

[Question] What kind of demands will be placed on MTESZ work by the expanding role of the technical, agrarian, natural scientific, and economic intellectuals and the expected strengthening of their creative spirit and action readiness?

[Answer] We can meet the new, greater requirements only if we adjust the work of our Federation, the associations, and the area organizations. We not only ask that the decision-making organs seek out the views of our members but it is necessary that we actually be partners in coming up with well-founded observations and proposals. Our great, unprecedented strength is in the broad circle of our social workers. Therefore, in the coming period we shall have to rely to an encreasingly greater extent on the cadre of experts working in the associations. This raises the requirement that we must increase more and more the professional understanding of our colleagues in our organization.

Operational Activity at the Center

As the recommendation of the Politburo also emphasized, we must continue to place the development of operational activity in the center of association work. The operational organizations must contribute to a still greater extent to increased production efficiency, innovations serving more economic management, and the working out and implementation of inventions. The technical, agrarian, natural scientific and economic intellectuals must be drawn more and more through the scientific associations into the preparation of enterprise decisions and the working out of development plans. We must realize more and more that very important principle of ours of further strengthening the economic thinking of our technicians as well as the

technical interest of the economic intellectuals, and the implementation of this complex outlook.

Nowadays we speak a great deal about innovation and the need to follow and assist creative thinking from the inception of an idea to its implementation. The MTESZ has enormous tasks to do in this field. Of course, I am thinking of tasks which are appropriate to the social nature of our Federation. To do this, we also need a flexible organization. Naturally, we must also create appropriate conditions for the higher level activity of our experts. The experiences with the Technique Houses that are in operation also justify our continuing to establish facilities of this kind, with the support of government organs, in the megye seats and the more important industrial centers. Hopefully, they will also give support by granting us favorable judgment on their operation, and that together with other social organs these shall be prepared for multi-purpose use. Recently, the MTESZ and its associations were granted a favorable decision for their Budapest location. We were assigned the former building of the Ministry of Light Industry, which is an almost perfect solution provided we can realize certain remodeling plans.

Among the proposals we made to the government, there was one which also was appropriate to the position taken by our general assembly, namely, the need to create greater possibilities for using the expertise and experiences of retired people. Various statutory provisions are still in effect which limit or obstruct greater use of and material recognition for their intellec-capabilities.

[Question] Have the problems you raised gained a hearing?

[Answer] We have received encouraging replies to our observations from the appropriate organs. For example, they have informed us that they will study this year the present rules for the employment of pensioners, and in the second half of the year they will make proposals for their comprehensive modernization. It also brings us a good feeling and happiness to earn increasingly greater respect for our work in that the MSXMP Central Committee, the Council of Ministers, and the national authorities concerned are receiving with understanding and good will the matters we raised, our requests, our problems, and our proposals. I cannot even think of a subject where we did not receive a worthy reply. And these reactions clearly show an increased respect for and a readiness to help the intellectuals who are organized in the 32 associations. Our perception of this can only give renewed encouragement for our work and for the fuller use of the resources of our creative intellectuals.

With the Resources of Our Associations, Our Membership

[Question] What goals has the MTESZ leadership set for itself?

[Answer] Our observations and proposals now regularly come before the appropriate organs for information, for adopting a position, for making a decision. Beyond giving our views, we contribute to speeding up technical

scientific progress also by working out independent initiatives and concepts and by a systematic and rational conceptualization of the what and the how. As an example, I might mention our joint initiative with the SZVT for calling a national conference of engineers-in-charge, or the national conference on increasing the efficiency of intellectual work. Or to continue the list: study of pollution in the Balaton' proposals for the development of public education; working out of new methods for language teaching; and the inclusions of commission jobs into a unified system. To these questions are linked the planned establishment of the MTESZ council of experts and office of experts. It was with this same goal that we established the Council of Seniors among retired intellectuals.

All these efforts serve the goal of helping the social organization which unites 32 scientific associations or 170,000 members to successfully carry out the tasks stemming from the resolutions of the 12th Congress and the Sixth Five-Year Plan by mobilizing the intellectual resources of the technical, agrarian, natural scientific and economic intellectuals; by discovering the reserves of resources serving technical progress; and by continuation training of the specialists at a higher level.

[Question] What results has the MTESZ achieved in collaboration with the trade unions in particular with respect to the larger role and tasks of the practical intellectuals?

[Answer] Above all, I would like to emphasize that the relationships of the sub-branch trade unions and the scientific associations have become more sysematic, closer, more concrete and more manifold. The further development of this increasingly fruitful collaboration and its extension to more and more branches is constantly on the agenda of our Federation. As a good example of our collaboration I might mention the jointly announced fifth national conference of innovators and inventors. We should work to assure that fewer and fewer good ideas are lost and that the material and other kinds of conditions for innovative activity should be improved. It is our joint task with the trade unions to see that the material and moral recognition of the technical, natural scientific, agrarian and economic intellectuals should increase in harmony with achievements, and that the power of attraction exerted by a technical career should grow. In order to put our economy on an intensive track, it is our joint goal to improve the effectiveness of intellectual work. In our Federation and our associations as are constantly studying and examining those conditions and factors which have a restraining effect on technical progress and knowledge. Tensions and problems arise in this connection. In our judgment, it would help a great deal if the trade unions were to react more rapidly and concretely to problems. We must improve this cooperation, and with this strengthen confidence between the trade unions and the intellectual workers. I am convinced that in the future the trade unions will do more and more for the development of the professional knowledge and creative energy of intellectuals.

Cooperating with the Trade Unions

In addition to material recognition, we need for the development of a better working atmosphere better recognition for specialists offering an outstanding

product, and an improvement of conditions. In any event, the national presidium of the MTESZ sees it as necessary to study in intellectual areas the more consistent realization of the principle of distribution according to work, accepting also a substantially greater extent of income inequality than at present.

The indispensable condition for the development of creative work at enterprises is the strengthening of democratism at institutions. It is the joint task of the MTESZ and the associations together with the trade unions to work out organizational forms and working methods that will make it possible for the practical intellectuals to participate more directly in the handling of common affairs. We can do a great deal through education and attitude formation to realize an unselfish will to do instead of the excessive materialism that is unfortunately evident in so many places. But at the same time this also means that we must manage human capabilities better and give more support to those who accept sacrifices for the common good.

It has already been emphasized at the meetings of our general assemblies that we are not an interest representational or interest protection organization. In accordance with our political and social development, this is attended to basically by the trade unions. In this area we do not wish to compete with them, but to help and to cooperate with them. It is also stated in the recommendations of the Politburo that our Federation should develop its relations with the trade unions. We should be able to strengthen our cooperation not least of all through the work of our plant and enterprise organizations. We need to promote an improvement in the efficiency of production, the working out and implementation of innovations and inventions which serve economic management, and activity in this direction by the working collectives and the socialist brigades.

[Question] As it appears frmm a review of the recent past, the MTESZ role in representing 32 scientific associations and the approximately 170,000 practical intellectuals who are its members has increased perceptibly. This is reflected in the respect shown by party and state organs and in the seeking out of Federation views on important decisions at the national economic level. Therefore, the tasks, too, have increased. Will the MTESZ and its associations be able to meet the greater expectations?

[Answer] This is our goal and we are working at this. We wish to adjust our working methods, our personnel and organizational structure, the inner life of the MTESZ and the associations to the new requirements.

Let Us Make Our voice Heard

The recognition we have received thus far is an honor to us as well as the request that we make our voice be heard in more and more questions of national economic importance on the basis of views formed in our associations and the Federation. Most recently, for example, we received a letter from the Council of Ministers in which they judge as valuable the proposals made in our comprehensive informational notice on the first national exchange-of-experience conference of engineers-in-charge, as well as the positions we

have taken and the observations we have made on the development of guidelines for housing construction and maintenance, and on housing management and distribution.

The reactions by the managing organs to the questions we have raised show that the expert positions and thought developed by the voluntary work of the association memberships are important. Moreover, we must strive to an increasingly greater extent to come up with concrete proposals in given questions as to what the authorities should do, and how, for the solution of problems and tasks. We are continuing to work on this, for the intellectual resources of our membership is capable of doing all this. And the confer nce that is being shown in us is multiplying our strength. At the same time, however, it indicates that we, too, must do much more than before for the attainment of national economic goals. And in order that in the coming period as well we shall be worthy of increased confidence.

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ORGANIZATIONAL CHANGES IN COMPUTER ENGINEERING COLLABORATION

Budapest SZAMITASTECHNIKA in Hungarian Mar 82 p 1

[Article by Tamas Hirschler: "Organizational Modifications in the Guidance of International Computer Technology Cooperation Activity"]

[Text] In January 1981 the Computer Technology Inter-Ministerial Committee passed a resolution concerning the combining of background organizations coordinating domestic and international computer technology cooperation. The purpose of the reorganization was to make branch guidance more effective, optimize the number of people in the guidance apparatus and improve the efficiency of international cooperation. The computer technology central development program (SZKFP) adopted for the Sixth Five-Year Plan also conceptionally urged a regrouping of the tasks of the secretariats and offices performing coordinating activity.

At the end of last year, after such antecedents, the office of the Hungarian members of the Economic Council of the Computer Technology Inter-Government Committee (SZKB GT), the International Secretariat for Bilateral Computer Technology Cooperation (KSZENT), the Computer Technology Technological and Parts Coordination Office (SZATKI), the Technical Coordination Office for Computer Technology Cooperation (SZEMKI) and the Computer Technology Research Information Service (SZKISZ) were combined. With the creation of the new integrated guidance system we achieved a reduction in personnel of about 40 percent and annual upkeep costs savings of 33 percent. The name of the new office is the Information Office Coordinating International Computer Technology Cooperation (NESZEK). Its address is Lenin Korut 77, Budapest VI, telephone 324-977.

The office is in the supervisory sphere of the Ministry of Industry and the OMFB [National Technical Development Committee] and it carries out cooperation and coordination tasks being realized within the framework of their ministerial obligations set forth in the SZKFP. The work apparatus of the chief authorities mentioned is maintained within the enterprise framework of the Videoton Industrial Foreign Trade Company, on a contract basis. The organization continues to carry out the secretariat and technical coordination tasks of the SZKB GT, of the permanent bilateral computer technology work groups (between ministries or technical development guidance organs) and of the domestic memberships of the SZKB [Computer Technology Inter-Government Committee] Temporary Technological Work Groups; it keeps the

administrative records for the research and development activity of the Computer Technology Research Target Program (SZKCP); and it operates the information system for basic data summarizing the achievements of the SZKFP.

The office is divided into three units: a department dealing with questions of bilateral cooperation, a department dealing with tasks of multilateral cooperation and a department operating the information system.

Practical work after the reorganization began at the beginning of January and in the transitional period it took care of tasks deriving from the earlier organizational structure and system of responsibility also. The regrouping took place without a hitch in the midst of substantive work. It is very gratifying that the personal and work contacts developed earlier with producing and foreign trade enterprises belonging to the contacts system for coordination work were maintained without change. They related with understanding patience and aid to the hang-ups which could be experienced unavoidably as a result of the reorganization. We must see in this, unambiguously, a recognition of the activity of the earlier coordination organs and a manifestation of trust toward the new office.

Within the framework of the information system of the SZKFP the office primarily collects, systematizes and maintains special records on enterprise production data and foreign trade data according to functional nomenclature or the ITJ [Industrial Products Register]. The data base is being supplemented with data summarizing research expenditures and results and with information recording technical-scientific cooperation tasks and evaluating results. The data base is still being designed; data collection will begin soon in accordance with the pertinent state prescriptions and permits. Full operation of the office is expected in the second quarter of the year.

The chief authorities cooperating in the creation of the office are turning great attention to classified handling of income data, to protect the institutional interests of the enterprises supplying data. A strict system controls the "out-flow" of synthesized data--and of the primary data submitted. The pertinent prescriptions apply to the activity of the office as a whole.

We believe that the creation of the new office represents not only a single organizational modification but rather a considerable improvement in coordination activity and the decision preparation mechanism as a whole and that it will result in a modernization of information flow. The necessary organizational, material and personnel conditions are given.

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HUNGARIAN COMPUTER EQUIPMENT IN USSR

Budapest SZAMITASTECHNIKA in Hungarian Mar 82 p 11

[Article by Otto Molnar, director of the Moscow Commercial and Technical Center of the Videoton Company, and K. Borisov, deputy director of the center: "Hungarian Computer Technology Equipment in the Soviet Union"]

[Text] In Hungary the Videoton Electronics Enterprise, the MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences], the SZAMKI [Computer Technology Research Institute] (the legal successor is the SZAMALK[Computer Technology Applications Enterprise]), the SZKI [Computer technology Coordination Institute], the KFKI [Central Physics Research Institute], etc. deal with the development of computer technology. Their activity is guided by the Computer Technology Inter-Government Committee (SZTB) [as published, "Inter-Ministry" was probably intended], which also makes up the Hungarian membership of the Computer Technology Inter-Government Committee(SZKB). The OMFB [National Technical Development Committee] undertakes a decisive part of the guidance of development.

Within the framework of the SZKB a developmental program for computer technology devices based on a uniform technical policy has been developed and basic principles for specialization among the individual countries have been defined. In accordance with the specialization principles Hungary began participation in the common work with the manufacture of the ESZ 1010 computer and a number of peripherals.

As of 1981 Hungary has been manufacturing the ESZ 1011 computer in place of the ESZ 1010. Its technical and economic indexes substantially exceed those of the previous model.

The most significant manufacturer of computer technology devices in Hungary is the Videoton Electronics Enterprise. The crucial majority of the computer technology devices manufactured are exported to socialist countries. The greater part of the deliveries are to the Soviet Union. Between 1976 and 1980 the value of the deliveries exceeded 300 million rubles. At present, working in various areas of the Soviet economy, there are 50 configurations of the ESZ 1010B systems and 300 configurations of the ESZ 1010 model--there are 61 in the area of the Railways Ministry, 53 in the area of the Energetics Ministry, 27 in the petroleum and gas industry, 30 with the Ministry

of Geology, 50 systems in institutions under the Academy of Sciences of the Soviet Union--including the federal republics--and a number of systems in other branches of the economy and in other scientific research institutes.

The systems delivered thus far work as modern decentralized data processing tools and as medium capacity computers in larger computer technology networks.

Videoton Reference Systems

At the Energetics Ministry the systems serve to collect, process, display and document information arriving at the dispatcher points of the power systems and energetics associations.

The computer technology systems operate in accordance with the operational mode of the energetics system operating under their guidance. They display processed information on a picture screen, monitor the parameters and operation of the energetics systems, forward informational data to the dispatcher and, in the event of a breakdown or if the values of the parameters being monitored go beyond the given limit values, forward warnings to the dispatcher. All central dispatcher stations of the ministry are supplied with ESZ 1010 computers.

At the Railways Ministry they have developed a computer guidance system for marshaling yards. Its fundamental tasks are:

--processing the documents and technological information accompanying the cars in such a way that instructions for assembling trains can be compiled on the basis of this information,

--developing an information data base concerning the location of cars standing in the yard, and

--preparing operational and summary reports on work done by the marshaling yards by shift and by day.

The use of computers at the marshaling yards makes possible a perfection of the technological processing system of the yards, decreases the idle time of cars, improves the working circumstances of those working in the technical offices and decreases the manpower expenditure.

At the Ministry of Geology they developed from a two-computer ESZ 1010 system an automated ocean survey station of the MARS type. The systems, operating on research ships, are used to collect, process and store geophysical and radio navigation data. The computer technology system is the chief element of the automated navigation system. A navigation system working with the aid of artificial satellites is part of this also. With the aid of the MARS system the efficiency of ocean bed research work has increased greatly and it is possible to determine with much greater precision the sites of certain mineral deposits on the ocean bed. Similar systems are used in geophysical research on dry land also. The computer technology system stores the data received and displays the results as desired on a plotter or on light sensitive paper.

Technical Services for Videoton Products

Hungary provides complete technical services for the computer technology devices deliverd by it also. For this purpose we gradually built up, beginning in 1972, an organization which is called, since 1977, the Moscow Commercial and Technical Center of the Videoton Company.

The basic tasks of the center are:

It discusses the following matters with the Soviet foreign trade organs and Soyuzglavpribor, the supply enterprise belonging to the Material Supply Committee of the Soviet Union and the enterprise which is the general purchaser of Hungarian computer technology equipment:

--delivery volumes,

--the configurations to be delivered and the time limits for delivery,

--prices, and

--signing the delivery contracts.

The Commercial and Technical Center provides complex technical service for the computer technology devices delivered, performing the following tasks:

--technical acceptance of machine products ready for assembly,

--assembling and putting into operation the systems jointly with the users,

--guaranteed servicing of the equipment during the 12-month guarantee time,

--repairs which become necessary after the guarantee time, on the basis of special contracts pertaining to services beyond the guarantee time, and

--training the experts of the user organizations within the framework of an appropriate study course system.

Hungarian and Soviet experts and service personnel work in one collective in the center. Personnel now number 175 of whom 121 are Soviet and 74 are Hungarian [as published].

In the interest of the successful performance of the tasks the Commercial and Technical Center is organized into the following units:

--management (the director and two deputies),

--training group,

--software group,

--service groups (to repair different types of equipment),

--claims group,

--laboratory,

--computer center,

-administration and customer service group, and

--warehouses.

From the moment a system reaches a user we precisely document what work we have done and what changes we make in connection with the given system.

Users can report problems arising to the dispatcher center. The dispatcher informs the chief of the appropriate group who sends experts, equipped with spare parts, tools and instruments, to remedy the problem. Parts and sub-assemblies which fail for the user are required in the laboratory. These (after repair) are put in the warehouse.

The computer center of the Commercial and Technical Center operates ESZ 1010 and ESZ 1011 computers. The training of users takes place here also.

In the course of the present five-year plan (1981-1985) we expect a significant increase in delivery of computer technology devices of Hungarian manufacture. The ESZ 1011 systems to be delivered are more modern and their technical and economic indexes are better. Among its peripherals one can find picture screen units and output devices, fixed head magnetic disk stores and line printers.

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PRESENT, FUTURE OF MINICOMPUTER SYSTEM

Budapest SZAMITASTECHNIKA in Hungarian Mar 82 pp 8-9

[Article by S. S. Zabara, B. N. Naumov, V. V. Rezanov and E. B. Smirnov: "Computer Technology in the Soviet Union; The Present and Future of the Minicomputer System"]

[Text] The fundamental applications areas for the MSZR [Minicomputer System] computer family are guidance systems for discrete and continuous technological processes, automation systems for scientific experiments, the systems needed for realization of automatic designing, and organization and guidance tasks. The many types of applications required that we solve, at the state and international level, a number of technical-scientific, production and economic problems. The more important are:

--unformization of technical devices and the methods of linking them (standard interface),

--adopting methods for basic design and development of special purpose systems which would make possible in a broad sphere the design and assembly of special systems and later duplication of them,

--realizing uniformization of design and technological solutions, at the level of international standards, which would ensure outstanding quality of the computer technology devices, the possibility of inter-branch and international cooperation and the possibility of conversion from large series computer technology production to mass production,

--development of uniform requirements necessary in regard to a long-range microelectronic element base, and

--organizing a countrywide network of institutions to provide assembly, installation and complex technical services.

The very short time available to us to create the MSZR required that we introduce new work organization methods. In the development of minicomputers we used for the first time in the Soviet Union a method of parallel execution of developmental phases which previously had been carried out sequentially; the development of technical devices, programs and user systems took

place in parallel. Simultaneous with this the electronics industry developed the modern elements base the mass use of which in the MSZR made possible a significant improvement in the technical quality of the products. We optimalized the structure of the MSZR computer family in such a way that the central units, and in some cases the control units for peripherals, could change for some models, but the basic assortment of peripherals and the devices to link computers are essentially the same for every model.

The basic technical solutions adopted within the framework of the MSZR satisfied the requirements for mass manufacture and can guarantee the possibility of automated or highly mechanized production. High level technological production preparation activity took place to introduce series manufacture of the MSZR.

At one of the leading enterprises of the sub-branch, the Kiev unit of Elektronmas, they operate five technological process control systems and 40 automated tuning and measuring systems on the SZM-4 manufacturing line for operations requiring the greatest responsibility. Beginning in the second year of their production they have been using SZM-3 and SZM-4 computers to carry out guidance and control tasks for the computer technology sub-branch The computers used for design of printed circuits, control of drill lines and final alignment have proved very effective.

Stepping up the production of computers makes it important to perfect and accelerate the development of the technology for program preparation and putting systems into operation. Solving these tasks made it possible this to be the first computer family in the Soviet Union for which users received an adequate supply of basic and applications programs immediately after series manufacture began.

Characteristics of the First Series of MSZR Computers

When executing short arithmetic and logical operations the speed of the processor reaches one million operations per second. Rational operational paging, using primarily hardware for processing interrupts and the possibility of automatic setting to different operational modes ensures that the SZM-4 models--the fastest MSZR computers--give a speed of 300,000 operations per second for real-time applications, recalculating to mean operations. (We established this with measurements done for a large number of real-time applications.)

Creating complex guidance systems, introducing optimalization methods and data base management, requires that there be available a larger operational memory than heretofore, together with the possibility of multi-level external information storage. The SZM-4 and SZM-2 models work efficiently with a memory of 128 K words. This satisfies the requirements of most technological process control, scientific research and scientific experiment automation applications and most dispatcher guidance systems.

Peripherals

Development and series manufacture of the peripherals needed for the mini- and microcomputers occupy a central position in the MSZR program. The price

of the peripherals makes up 70-80 percent of the price of computer systems and the peripherals have a crucial effect on the technical and use parameters of applications systems and on their productivity and reliability. The very broad applications sphere of the MSZR computers makes necessary a large assortment of peripherals.

At present the assortment of MSZR peripherals contains every type of device practically needed for creation of computer guidance systems in the various areas of the economy. The assortment contains more than 100 items of equipment, not counting the equipment needed for remote processing, the equipment added for process control and equipment recording production.

A functional line of external storage devices based on magnetic data carriers has been developed. This includes cassette magnetic disc stores up to 30 M byte capacity, cassette and normal magnetic tape stores and floppy disk stores. The family of printers contains character (synthesizing) equipment with speeds of 100-180 characters per second and line printers with speeds of 500-900 lines per minute. In many places they are using picture screen equipment--alphanumeric and graphic displays, including intelligent, color and semi-tone devices. Substations represent the equipment providing a link between operator and machine, these include two types (black, white) of displays with capacities of 512 or 2,000 characters. They are equipped with the tools needed for editing and the graphic display makes possible the drawing of mnemonic designs. It is possible to develop process control technology work sites where one can observe the functional needs of the engineering work sites and the topological arrangement of the system.

Research on peripherals operating on the basis of traditional principles is aimed at improving the technical and economicalness indexes.

This includes the following:

--in the case of magnetic storage equipment we must increase reliability, the speed of information transmission and the density of writing. This will require use of integrated magnetic heads and a perfection of the magnetic layers of the carriers;

--in the case of picture screen equipment we must increase the processing capability, the number of degrees of light and the built in intelligence; and

--in the case of striking printer equipment we must increase reliability and capacity and decrease the size and the amount of noise.

In the further development of the MSZR peripherals we adopted as a base the principle of decentralized control. Peripherals will be connected to a computer technology system in the form of a system or terminal and will be equipped with microprogrammable control equipment or built-in microprocessor. The development of the microprogrammable control equipment for this purpose is already finished.

The development will provide the following advantages:

--the task of assembling special purpose systems will be substantially simplified (especially for systems distributed in space) and the generation of operating systems needed for these will be substantially simplified;

--it will be possible to produce subsystems separately, autonomous functional control will be possible and it will be possible to deliver them to users separately;

--the way in which subsystems are used will be simplified, primarily because it will become possible to test and diagnose them autonomously;

--the time and memory of the central unit can be used more thriftily and the reaction capability of the system will increase; needs supported by central unit reactions will decrease; unforeseeable coincidences and conflicts can be eliminated (these occur in present systems because the various units of equipment operate independently of one another in an asynchronous way);

--connecting peripherals will be simplified and the further perfection of them will be easier; and

--in the great majority of cases sizes and prices will be reduced substantially and the reliability of the entire system will increase.

Examples of Developing Systems

In the case of equipment for the SZM-3 and SZM-4 computers, an adapter providing a link between the AMSZ processors and a PS bus connector serve to create multi-computer and multi-processor systems. The adapter providing contact between processors can be connected to the common bus lines on both processors. Via the adapter any processor of a multi-computer system can turn to any other processor, or to a peripheral of the other computer, if it is connected to the common bus. By means of a program it is possible to provide which parts of memory can be accessed by other processors.

Depending on the concrete applications conditions a two computer system, for example, can be used in the following operational modes.

--The P1 processor has a P2 processor as a reserve. In this case the P2 processor processes information in the background mode and from time to time asks the other processor for use of the bus connector.

If the P1 processor fails then the bus connector switches to the P2 processor which immediately takes over control in the real time mode. The operative nature of the system can be increased if a supplementary operational memory is connected to the supplementary bus also.

--Division of functions. One can imagine, for example, that the P1 processor takes care of collecting information, swiftly evaluating it and writing it onto external data carriers in accordance with the loading of the memory.

The P2 processor, on the other hand, going through the bus connector at certain intervals, accesses the information and processes it in accordance with the previously supplied, complex algorithm.

Remote Data Processing Devices of the MSZR

The following types of equipment are planned to develop remote processing systems based on the MSZR: modems, signal transformers, multiplexers and adapters, automatic call equipment and a number of terminals made up of different components for different purposes.

Here are a few examples of the possibilities for developing remote processing systems based on the MSZR:

--links between a computer technology system and remote terminals;

--links between a computer technology system and remote terminals in such a way that conversations needed for service can be conducted through a telephone connected in parallel.

--linking two computer technology systems via a leased or connected telecommunications line, with the possibility of making an automatic contact;

--linking a computer system to a terminal in the immediate vicinity; and

--linking a computer technology system based on the MSZR with a system made up of ESZR [Uniform Computer Technology System] equipment.

Software

As a result of the realization of the first MSZR series a base of modern technology was created to develop porgram products and document programs. In harmony with the general basic principles of the problem oriented nature of MSZR systems the technological tools and devices needed to design and develop program products are goal oriented also, according to the following principles.

The program modules serving as basic tools can be grouped as follows:

--logical and mathematical processing of data; these include programs for mathematical statistics, numeric analysis, optimalization methods, network design methods and guidance methods based on network plans, etc.;

--data processing technology programs, which provide for collection of data preliminary processing, reading in data with various formats, data transmission on telecommunications lines, creating and supplying data structures, displaying data, etc.;

--programs to control and service peripherals, provide syntactic and semantic expansions and set up links between multi-computer systems;

--programs to check and diagnose technical devices;

--organization and guidance of computing processes; and

--programs facilitating the link between user and system.

Tools serving to generate operating systems represent the next, higher level of programming tools. With the aid of these one can adapt to various applications conditions and to various configurations of computer technology systems.

We kept in mind primarily the ability to generate the following types of operating systems:

--general purpose systems for program preparation and testing (punch tape and disk based);

--real time systems (multiprogramming punch tape and disk systems for small configurations, systems to control processes which take place quickly, systems running several tasks simultaneously and serving a broad sphere of applications, where one must control systems consisting of many and complex elements in real time);

--time distribution systems (where one must solve informational and logical or calculation oriented tasks in a collective user operational mode); and

--systems for complex measurement and testing of technical tools.

Under the control of the operating systmms one operates programming systems which can provide, in the conversational mode, preparation and testing of programs in the following languages: Assembler, Macro-Assembler, FORTRAN, BASIC, BASIC-Plus, DIASP, DIAMS and COBOL. We developed a number of applications program packages to expand the possibilities of the operating systems and strengthen their problem oriented nature; these packages are procedure or problem oriented. These include progrmas for numeric analysis, mathematical-statistical, network design and guidance programs, programs for object link and remote processing equipment, computer graphics programs, programs to manage data banks in hierarchical multi-computer systems, programs to model continuous, discrete and semi-continuous processes, programs for technical-scientific and economic calculations, instructional systems and data processing systems to automate scientific experiments.

Basic Trends of Further Development

A complex program, worked out for the years 1981-1985, for manufactuer and further development of MSZR technical and program tools provides the basis for the work being done in the Soviet Union, and parts of it deal with the work of countries participating in the computer technology cooperation of the socialist countries.

Each model of the second series will be made on the basis of highly integrated circuits, including n-MOP technology, 8 and 16 bit microprocessors and solutions based on low output TTLS technology.

The models in this category can be used to develop computer systems with various configurations (such as a system for economic calculations based on

the SZM 1800) or to build up hierarchic and distributed systems, including remote processing networks. They are compatible at the program level with the SZM-3 and SZM-4 machines and have an adaptive architecture to operate at the highest level of hierarchic systems; in addition to the basic operational mode they are capable of being operated in a mode compatible at the program level with ESZR machines or (if need be) in the operational mode of other computer systems.

Research being done in the area of peripherals based on new principles will make it possible for us to create in the next five-year plan:

--optical-electronic information storage devices working on the basis of photographic or thermic carriers;

--peripherals for input and output of graphic and symbolic information working on color ray and laser principles;

--information display devices based on lasers and gas discharge;

--medium integration microcircuits based on TTLS technology;

--static and dynamic operational storage units using highly integrated circuits made with n-MOP or K-MOP technology;

--TTLS based PROMs;

--programmable logic matrixes based on TTLS technology; etc.

We hypothesize the creation of the following basic computer classes:

--Microcomputers intended for autonomous applications, intelligent terminals, terminal substations, industrial control equipment, etc. Taking into consideration the requirements of systems applications we have considered, in addition to the basic design, the creation of microcomputers which can be used in especially hostile environments or those which meet CAMAC standards for systems automating scientific research.

--A computer series which will be compatible at the program level with the machines of the first series, the SZM-3 and SZM-4, but which will have higher technical-economic and utility parameters. In the configurations of such machines there will be special processors for various purposes (oriented toward matrix operations, languages, file management, etc.) which will make it possible to increase the power of these machines by one or two orders of magnitude when solving the appropriate tasks.

We plan to create an equipment assortment from which one can create many versions of computer technology systems, guidance systems and computer networks. The link between elements in the networks can be any standard telecommunications channel--teletype, leased or connected telephone line, galvanic line. In addition to traditional data transmission equipment we plan the development of terminals and terminal substations which make

possible the creation of functionally complete remote processing systems, based on uniform technical and programming principles, all the way from multi-terminal substations to network remote processing systems.

The program includes the development of software with which one can operate highly reliable multi-terminal systems distributed in space in which--in the collective operational mode--it will also be possible to do testing and remote diagnostics. There will be technologically oriented program systems for program development, preparation of documentation and user instruction and various applications program packages for the areas in which the MSZR is most often used.

The program also proposes the development of several types of computer systems based on multi-computer configurations which may be the basis for the development of concrete user oriented systems. First of all this will involve two computer systems realizing various types of cooperation between the two computers.

Implementation of the program will make it possible for us to achieve the front rank in regard to all basic user criteria--functional completeness will expand, capacity will increase, more varied configurations can be developed (this includes program tools) and the reliability and life expectancy of systems will increase.

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ELEKTRONIKA-60 MICROCOMPUTER

Budapest SZAMITASTECHNIKA in Hungarian Mar 82 pp 9, 11

[Article by Jozsef Bella: "The Elektronika-60 Microcomupter"]

[Text] There is ever increasing interest in microcomputers not only throughout the world but among domestic users also. This is justified by the small size and relative cheapness of the equipment. They can be used best as independent data processing systems in various areas of economic, scientific and technical life but they can also be elements of "network" systems and can guide production and technological processes.

The Elektronika-60 (EL-60) is manufactured by the Electronics Association which belongs under the supervision of the Soviet Electronics Industry Ministry.

In regard to both hardware and software it is compatible with the DEC LSI-11 computer. Its instruction set (which is compatible with the PDP 11/35/40 instruction set) makes it possible to exploit the advantages of PDP 11 software.

Thus one can run on the El-60 the developmental programs of the PDP 11, such as ASSEMBLER, LINKER and EDITOR, the loading programs, user program packages, operating systems and translator programs for high level languages.

The system has modular construction; each functional unit makes up one block and information exchange between blocks takes place on a common channel (bus). Thus the computer makes up a modular system linked together by the bus. Since the link between individual units of the modular system takes place in the same way via the bus the peripherals can be accessed by the central unit as easily as the operational store.

The advantages of this solution are:

--the central unit can exchange information with any peripheral without using memory, and

--the peripherals can exchange information with memory and with each other without the central unit.

The link between units connected to the bus takes place on the MASTER-SLAVE (active-passive) principle. At any given moment only one device can be active and can initiate information exchange. The MASTER unit controls the cycle for turning to the bus, satisfies--if necessary--the interrupt request of the peripherals and controls direct access to memory. The SLAVE unit can only execute and can take or give information only under control of the MASTER unit. A typical example of such a link is the link between the central unit (as MASTER unit) and memory (as the SLAVE unit).

The link via the bus is closed; that is, an answering signal from the SLAVE unit must be given to the control signal given by the MASTER unit. Thus the process of information exchange between them is not dependent on the answering time of the SLAVE unit (within 10 microseconds). As a consequence of this there is no need for so-called cycle signals--this the link is asynchronous. Information exchange can take place with any unit at the maximal speed determined by the unit.

The bus makes possible various data transmission methods--program controlled, direct memory access and program interrupt.

Program controlled data transmission is data transmission initiated by the controlling program. Prior to initiating data transmission the content of the state register of the unit must be checked to see if the unit is ready to carry out data transmission. The direct memory access method is the fastest data transmission method between memory and a given peripheral. This data transmission does not change the state of the central unit. That piece of equipment which is working in the direct memory access mode must carry out all the functions of the MASTER unit--addressing, producing control impulses and, if necessary, regeneration of memory, checking the length of the block of data to be transmitted, etc.

A given peripheral can receive authorization for direct memory access only after completion of the running turn-to-bus cycle, that is, in the pause between the execution of two instructions. At the [illegible]e of program interrupt the central unit serves the unit requesting the inte[illegible]pt. The units requesting interrupts have a special program to handle interrupts, entry into which takes place with the aid of a so-called interrupt vector. Addresses 0_8 to 376_8, expressed in the hexadecimal number system of the operational store are maintained for the interrupt vectors. Each vector needs two 16 bit store cells so the addresses of the interrupt vectors are paired and can end in 0 or 4. The interrupt system is a priority system with multiple levels. The individual peripherals are connected to a definite level. Several peripherals can be connected to single levels. The order is based on the electric distance of the devices from the central unit. That unit has higher priority which is closest to the central unit electrically. Any unit can again interrupt the program serving the first unit if the state register of the central unit makes this possible. Thus the service programs can be "embedded in one another" to the level desired.

When determining the priority order the following factors must be considered: fast devices have highest priority; but highest priority must also be given to those devices from which the originating data cannot be repeatedly produced.

Technically the common bus organization also has the advantage that it makes it possible to address and handle the state, address and data registers of the peripheral controls as memory cells. Since the central unit turns to the registers of the peripherals in the same way as it turns to memory those instructions which handle data to be found in memory can be used to handle data to be found in the registers of the peripherals also. Data which can be found in the registers of peripherals can be analyzed without sending them to memory or a general purpose register, or one can perform on them arithmetic and logical transformations.

In general the upper 4 K addresses of memory are peripheral registers. The basic functional blocks of the central unit are the LSI IC's making up the microprocessor:

--control IC,
--arithmetic-logical IC, and
--three permanent memory (RAM) IC's.

The central unit is microprogrammed. The microprogram memory contains the microinstructions. The microinstructions emulate the instruction system of the computer and control the internal registers of the central unit and its arithmetic-logical unit, internal information traffic, maintaining contact with the bus and the loading of the initial program.

The arithmetic-logical unit also contains the eight fast general purpose registers which carry out various functions.

They can be used as storage, index, auto-incrementing, auto-decrementing and stack-pointer registers.

The chief technical data of the central unit are:

--Instruction system: no address, one address, two address.

--Addressing modes: register, intermediate register, automatic incrementing and decrementing, intermediate automatic incrementing and decrementing.

--Levels of requesting bus service: two.

--Levels for peripherals to request bus service: three.

--Number of instructions: 80.

--Cycle time of memory: a maximum of 2.4 microseconds.

--Method of information processing: parallel.

--Method of control: microprogrammed.

--Arithmetic operands: fixed decimal, floating decimal.

--Length of arithmetic operands: 16 bits with normal precision.

--Length of arithmetic operands: 32 bits with double precision.

Memory: This serves for temporaty storage of information and is connected directly to the bus. In its basic design the EL-60 has 4 K words of memory (one word equals 16 bits), which can be expanded to 32 K words. The manufacturing firm has developed two models to expand memory, the P-2 (4 K words) and the P-3 (16 K words).

Peripheral control adapters: The many types and large number of peripherals which can be fitted to the EL-60 computer are well known. Like the memory module the peripheral controls are connected directly to the bus. Both a Consul-260 typewriter and a picture type terminal can serve as console.

The peripheral control adapters developed for the EL-60 computer are: V_1 for the consol (Consul-260 typewriter); V_{21} for the tape punch (PL-150); V_3 for the punch tape reader (FS-1501); Y_2 is a parallel control adapter (maximum data transmission in the case of programmed control, 180 K bytes per second); Y_3 for a DMA (direct memory access) UUML magnetic tape unit (SZM 5003); Y_4 for a (NGMD) floppy disk, control adapter for the SZM 5400 magnetic disk; and Y_5 is a sequential control adapter with a transmission speed of 50, 9,600 bits per second.

The present programs for the EL-60 are: paper tape operating system; EDITOR, ASSEMBLER translator, editor; BASIC, test programs.

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PARTICIPATION OF THE SOVIET RADIO INDUSTRY IN THE UNIFORM COMPUTER SYSTEM

Budapest SZAMITASTECHNIKA in Hungarian Mar 82 p 9

[Article by J. P. Selivanov, NICEVT: "Computer Technology in the Soviet Union; Participation of the Soviet Radio Industry in the ESZR (Uniform Computer Technology System)"]

[Text] At the time of the signing of the Inter-Government Agreement aimed at the multilateral computer technology cooperation of the socialist countries very much experience had accumulated already in the Soviet Union in the area of developing and organizing series manufacture of second generation computers belonging to the various classes. In the socialist countries also there was rather wide knowledge of the BESM and Minsk computer families, the M-220 and M-222 computers, produced by industry at the end of the 1960's and the beginning of the 1970's. We can regard this production experience as one of the most significant contributions of the Soviet Union in the initial phase of cooperation.

In 1968-1969, in the period immediately preceding the signing of the Inter-Government Agreement, preliminary plans were being prepared in the Soviet Union for a family consisting of third generation computers compatible with one another at the program level, a complex standardization program in the area of computer technology had begun, industry was being prepared to accept new technological processes, factories producing computer technology devices were being expanded and new ones were being built. This work followed directly from the resolution of the 24th congress of the CPSU which prescribed a perfection of the guidance system of the economy.

After the signing of the agreement the Soviet experiences became accessible to developers of all participating countries and they were used successfully in the following stages in execution of the long-range cooperation program in one of the most advanced and extraordinarily swiftly developing areas of industry, the computer technology industry. In many respects this was decisive in regard to the technical and scientific progress of the socialist countries.

As is well known, the development of the machine and program tools of the first ESZR series came to an end in 1972-1973, when series manufacture of these tools began. Soviet developers represented themselves in the

nomenclature of the series with three models--the ESZ 1020, ESZ 1030 and ESZ 1050. The performance of these was 20,000, 80,000 and 500,000 operations per second respectively. Experts from Bulgaria and Poland also participated in the development of the ESZ 1020 and ESZ 1030 computers.

In the course of designing these three computer models Soviet experts solved a number of technical and scientific problems; they developed basic principles for the electronic design of computers working with integrated circuits, methods for microprogrammed control of computers with various capacity, realization of modern input and output models, a system of uniform power units for computers working with integrated circuits and the satisfaction of international standards pertaining to codes, writing methods and carriers. They created a number of new peripherals, among which the exchanged magnetic disk stores merit special mention.

All computers of Soviet manufacture, or every functional group thereof, are supplied with the following peripherals: ESZ 5551 disk control unit; ESZ 5050 and ESZ 5056 magnetic disk stores with a capacity of 7.25 M bytes; ESZ 5010 magnetic tape units with a writing density of 32 bits/mm; ESZ 7030 and ESZ 7032 line printers; ESZ 6012, ESZ 6013 and ESZ 7010 punch card input and output units; ESZ 6022 and ESZ 7022 punch tape input and output units; ESZ 7906 alphanumeric picture screen system; ESZ 7064 graphic picture screen; ESZ 7051 plane plotter or ESZ 7052 and ESZ 7053 plotters; and ESZ 9011 punch card and ESZ 9020 punch tape data preparation equipment. A few of these, for example the ESZ 5010, the ESZ 7010 and the ESZ 7030, are versions of models developed earlier for the second generation computers.

In the course of further development it became possible to connect them to the ESZ standard interface. All other equipment was developed especially for the purpose of use in the ESZR.

Series manufacture of these computers and devices made possible realization of the prescriptions of the ninth five-year plan (1971-1975)--increasing the production of the computer technology industry 2.7 times. In the course of the ninth and tenth five-year plans Soviet industry produced several thousand computers in the ESZR series. Several thousand automated guidance systems and computer centers in various areas of the economy work with these computers. Simultaneous with the development and the introduction of series manufacture of the ESZR computers wide scale work was begun to create a centralized complex technical service organization and to develop instruction centers.

After completion of the first developmental phase, modernization of the machines of the first series began in the Soviet Union, in the course of which the possibilities of the computers were expanded and their technical and economic parameters were improved. Series manufacture of the ESZ 1022 and ESZ 1033 began in 1975-1976; these replaced the ESZ 1020 and ESZ 1030 types. Series manufacture of the ESZ 1052 computer, replacing the ESZ 1050, began in 1978. The capacity of the new machines was increased 1.5 to 3 times, with an insignificant increase in price. The capacity of the operational stores in the configurations delivered became larger, and it became

possible to connect the new 29 M byte disk units of Bulgarian manufacture. In these computers the operational stores are already semiconductor stores and they work with the aid of bipolar ICs.

Series manufacture of remote processing systems began in 1975-1976, in the course of which various types of multiplexors, terminals and line connectors (modems, error protection equipment, etc.) are being made. The ESZ 8400 multiplexor makes possible the use of 15 teletype or telephone lines with a speed of 50 to 2,400 bits per second. In its maximal version the ESZ 8402 multiplexor aids the transmission of information on 176 lines at a speed of 50 to 2,400 bits per second. The fastest multiplexor is the ESZ 8403, with a speed of 48 K bits per second on four lines. At this speed one can exchange information even between two computers. The simplest Soviet developed terminal is the ESZ 8570 based on an electric typewriter. For higher level tasks there is the ESZ 8504 which can be supplemented with picture screen, printer, plotting device, and a magnetic tape unit. From such equipment they have created and are successfully operating a remote data processing system and a few large capacity, collective use regional computer centers.

In accordance with the work program adopted by the member countries of the agreement developments aimed at creating a second series began with the preparation of the first series of the ESZR; in the course of this we must further improve the technical and economic indexes, carry the capacity limits farther and introduce new functional possibilities. Within the framework of the second ESZR series they have created in the Soviet Union a number of new computer models and many items of equipment of various types. Three computers are already in series production (the ESZ 1035, ESZ 1045 and ESZ 1060 models) and developmental work on the ESZ 1065 is continuing. The smallest of these is the ESZ 1035. Its capacity is between 125,000 and 200,000 operations per second, depending on the type of task; the size of its operational store is 0.2-2 M bytes; and the total channel capacity is about 1,600 K bytes per second. One unique characteristic of the ESZ 1035 computer is that with program and technical tools it can emulate the Minsk-32 computer. (As is well known, there are at present very many automated guidance systems operating in the Soviet Union which were created on the basis of the most widespread second generation computer. The ESZ 1035 will make it possible to convert these systems to ESZR technical devices without any special problem.)

The performance capability of the ESZ 1045 computer is 800,000 instructions per second and the capacity of its operational store can be between 1 and 4 M bytes; the combined throughput of the channels can reach a value of 5,000 K bytes per second. The high performance is given by a special accelerating device built into the processor; this significantly increases the speed of executing arithmetic operations. In its basic configuration this computer contains all the devices needed to create two or multi-computer systems. The computer is outstanding for its space saving design also--the entire processor and six channels fit into one standard ESZR cabinet. From the user viewpoint it is a very valuable property of the ESZ 1045 that it has a developed microdiagnostics system and a built-in diagnostic system operating down to the level of the printed circuits.

At present the ESZ 1060 is the highest performance ESZR computer in the Soviet Union and the other socialist countries manufactured in series. Its capacity exceeds one million operations per second, the capacity of its operational store is 2-8 M bytes and the throughput of its channels is 10-16 M bytes per second. One can find in this computer all those properties which characterize "super-high" performance computers--a buffer store, long word length, multi-layer access in the operational store, an accelerated multiplication unit and a separate cnntrol and diagnostic module.

All three computers described are made in harmony with the basic principles of the second ESZR series--they have an expended instruction system, virtual memory and expanded check and diagnostic devices.

Development of the largest ESZR computer has reached its concluding phase. Its performance capability will reach 7 million operations per second.

Simultaneous with starting manufacture of the new ESZR models the Soviet Union began manufacture of a series of new peripherals developed there. First among these we must mention the 100 M byte exchangeable magnetic disk stores, the ESZ 5066 units, which can be linked to the computer through the ESZ 5566 control unit. For the second ESZR series computers they are manufacturing in series a new punch card reader, the ESZ 5019, which reads 1,200 cards per minute, and the ESZ 6015, which reads 300 cards per minute. In addition there are the new ESZ 7037 line printer and the ESZ 7920 group display station in the development of which experts from the GDR, Poland and Czechoslovakia participated.

Soviet experts are leading the development of ESZR operating systems (OS-ESZ and DOS-ESZ). Several versions of operating systems have appeared already in the course of work in the ESZR area and there are program tools which further expand the possibilities offered by the operating systems. We would like to stress frist of all the contribution which Soviet experts made by creating the OKA data base management system and the KAMA remote processing control system. These are already being delivered to users. Soviet programmers developed a large number of applications program packages for the most varied applications areas, such as automated systems at various levels and automated engineering design systems using ESZR computers.

The above facts can characterize in a general way the contributions of the Soviet Union to that great work which is being done in the area of creating ESZR technical and programming tools within the framework of the multilateral computer technology cooperation of the socialist countries.

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DEVELOPMENT OF MAGNETIC STORES AT MOM

Budapest SZAMITASTECHNIKA in Hungarian Mar 82 pp 1, 7

[Article by M. T: "Development of Magnetic Stores at the MOM (Hungarian Optical Works): Keeping Up With the World Level"]

[Text] Relying on socialist cooperation and division of labor we have developed a variety of products of our computer technology industry in accordance with the conditions and traditions of our economy. The role of equipment of domestic manufacture is significant in satisfying domestic [illegible] needs; at the same time, the volume of our export in the socialist relationship and the non-ruble accounting relationship is increasing. Our computer technology manufacturing industry is concentrated on a few enterprises--Videoton, MOM, the Telephone Factory, BRG [Budapest Radio Technology Factory], Orion and VILATI [Institute of Electrical Automation]. The names of most of them hardly betray what a variety of products come from their assembly lines. Just as the Telephone Factory manufactures not only telephone equipment and the Orion Radio and Electrical Works manufactures not only radios, television sets and high fidelity equipment so neither does the Hungarian Optical Works manufacture only optical instruments. In terms of value it is the second largest computer technology manufacturer in Hungary and a significant percentage of its production value consists of computer technology equipment.

The MOM has been active in instrument technology for more than 100 years but it has been developing and manufacturing computer peripherals for only the last 10 or so years. The development in this area at the factory has been at an imposing rate during so brief a time. Work started around 1970 with the production of punch tape peripherals. Adapting to the needs of the market, it has constantly modernized its product structure; the manufacture of computer technology devices developed into a branch making up one third of the production plan; and they are counting on further growth of 8-10 percent per year. The earlier forecasts--according to which punch tapes devices would have to be phased out and the manufacture of magnetic carrier devices would have to be realized in the 1980's--proved to be correct.

In the middle of February, at a conference organized jointly with the Computer Technology Department of the NJSZT [Janos Neumann Society of Computer Technology] and the Computer Department of the Measurement Technology and Automation Scientific Association, workers from the MOM reported--before a

large audience of about 130 persons--on their results achieved thus far in the area of magnetic peripherals and on their long-range developmental plans. (We would have liked to have heard a separate presentation on how the competitiveness of their products is judged from the commercial viewpoint on the world market, in both capitalist and socialist countries, with special regard to the market interest and cooperation readiness of the latter). In the survey and evaluative presentation by Jeno Gulyas, computer technology chief designer of the factory, we heard the following.

Floppy Disk and Fixed Magnetic Disk Stores

The MOM conducts applied research and development and manufacturing activity in two areas of magnetic carrier peripherals--floppy disk and fixed magnetic disk stores.

The floppy disk family contains a broad scale of both 8 inch and 5 1/4 inch versions. They are manufacturing series of several thousand units of the MF 3200 8-inch devices, which they developed themselves. Building on the technical and technological experiences with these they succeeded in developing devices interchangeable with the Shugart floppies, the most widespread in the world, which are competitive on every market (from the patent viewpoint).

The new 8-inch family is based on the MF 6400 design. This equipment is suitable for attaining double writing density, ensuring the technical parameters of the leading western devices. The MF 6400 D two-sided, double capacity version has undergone state and international tests with outstanding results. Series manufacture of the MF 6000 will begin in 1982 and that of the D version in 1983. The appropriate design and modern technology together ensure large series manufacture satisfying high quality standards.

The 5 1/4 inch floppy disk stores (minifloppy) also follow the above ideas. The MF 900 and MF 1800 devices--which are suitable for ordinary or double writing density--received the code numbers EC 5088 and EC 5809 in the successful ESZR [Uniform Computer Technology System] tests. Series manufacture of them will begin this year, and first of all will satisfy domestic needs!

Further development plans are aimed at a two-sided, double-band, double writing density drive unit with a capacity of 1 M bytes by 1984.

The work of the developmental experts also extends to preparation of various testing tools, manufacturing and servicing equipment, documentation and programs.

The MOM began manufacture of fixed magnetic disk, fixed head (head/band type) drive units on the basis of French (SAGEM) license and know-how. The independently developed versions of the basic type (DM 0.8) already have capacities of 1 and 2.5 M bytes. Another license was purchased from SAGEM in 1976. Series manufacture of a 5 M byte disk drive unit begins this year and the prototype of a further developed 10 M byte version will be prepared this year also.

It is a significant accomplishment that they were able to replace a number of capitalist import parts with those of domestic manufacture.

On the basis of license technology the MOM is already manufacturing ferrite heads, purchasing the basic material, and also on the basis of a license it is manufacturing the information carrying disks of the fixed magnetic disk drive units.

(They are also striving to replace the import of the read-write heads for the floppy disk drive units; the first experimental series will be manufactured this year.)

Further developmental possibilities for the head/band type drive units depend partly on the read/write head and partly on the information carrier disk. At the end of the 1970's a number of firms came out with so-called integrated head storage units which do not limit writing density. The MOM is also preparing to develop an integrated head and, together with sister institutions, is working on the further development of a metal layer disk. The goal is to develop highly reliable (an MTBF above 8,000 hours), large capacity (a minimum of 60 M tytes), short access time (10 ms) units.

Flexibly following the world trend, the program includes development of Winchester type disk drive units also. The manufacturers marketed an 8-inch type 1-2 years ago and widespread use began in 1980. The first larger applications of the 5 1/4 inch micro-Winchester are expected to appear this year. According to the ideas the MOM will have its products on the market in 1984--with a delay of only 2 years.

Technological Developments

Mariann Mokos spoke about the technological development needed for large series manufacture of the 8-inch floppy disk drive unit family. The high precision parts are worked with NC-CNC machines and classification of the subassemblies is done with various electronic tools. The coordination of mechanical and electronic assembly-testing processes has succeeded well. Swift servicing of the MF 6400 is ensured with modular construction. Every mechanical unit is connected to each electronic part with one connection, thus the parts being made in the various provincial factory units of the MOM can be shipped and assembled easily.

They tried to make the tuning in of the assembled devices as simple as possible. The final testing includes a dynamic reliability test, with which they test the resistance to various environmental effects. For this purpose they use equipment they developed themselves based on an 8080 microprocessor. This makes possible the measurement of a number of floppy disk drive units at one time.

Tames Kertesz described interesting new technical solutions regarding the parameters and applications possibilities of the MF 900 and MF 1800 mini-floppy stores. We mention only two data to show the reliability of the devices: the so-called soft error is 10 to the minus 8 and the MTBF value is above 5,000 hours.

Jozsef Mara reported on the practical design experiences acquired in the course of development and manufacture of the head/band type drive units.

Solving the design problems of the head unit certainly meant a great success for the development experts of the MOM.

The Future Belongs to the Winchester Stores

We have already dealt in our journal with the Winchester stores, about which Tamas Kertesz gave a talk. (SZAMITASTECHNIKA, September 1981.)

The increasing capacity and decreasing size and price of computers made it necessary to develop a new type of magnetic background storage which will resolve the technical problems of the present types and provide large capacity with high reliability in a small size at a favorable price. This device is the Winchester drive unit. Its information carrier is a rigid, non-replaceable magnetic disk in a closed space on which the writing and reading of data take place with moving magnetic heads. The advantage is that with its use the capacity of background stores increases substantially, its reliability is good, similar to that of fixed head stores, it can be made to a floppy scale and its production cost is small. The disadvantage is that the disks cannot be exchanged, so the system also needs exchangeable disks.

The first Winchester type device--the IBM 3340 using a 14 inch disk--appeared in 1973. Since then various manufacturers have put another 88 types on the market. Their capacity ranges from 16 M bytes to 2,660 M bytes. With the spread of the 8-inch floppy disk stores a need arose for the manufacture of large capacity Winchester type stores of the same size and the first such device appeared in 1978, followed by another 61 types. These have a storage capacity of 5 to 64 M bytes. Mass use of the 5 1/4 inch minifloppy in desktop computers was followed by the development of micro-Winchester stores of the same size. Since the first such device, made in 1981, seven types have appeared; their storage capacity is 5 to 12 M bytes.

The technical solutions of the three types of different size are similar. The chief difference is that head movement in the 14-inch device is based on the technology for exchangeable disks while those of 8 and 5 1/4 inches followed the solutions used in floppy disk drive units.

Data format, internal control and the link to format control in the Winchester stores of the same size as floppy disk drives are organized in a way similar to that of a floppy disk. The reason for this is that in general they are used as stores supplementing one another. The floppy disk has a small capacity but it can be exchanged while the disk of the Winchester store has a large capacity and cannot be exchanged, but its data transmission speed is more than ten times that of the floppy disk.

Chief Technical Parameters of Two Well Known Types

	Shugart SA 606	BASF 6172
Capacity	10 M bytes	24 M bytes
Data transmission speed	4.5 M bytes/s	6.4 M bytes/s
Number of disks	3	2
Stepping time band to band	18 ms	8 ms
Mean data access time	75 ms	50 ms
Number of bandspper surface	160	600
Size	83 x 146 x 210 mm	115 x 230 x 460 mm

The appearance of the Winchester stores gave a new impetus to the development of magnetic disk stores. Costs can be decreased with series manufacture; on the basis of the small size and reliable operation they fit in quickly into the present store hierarchy. The 8 and 5 1/4 inch Winchester stores are used in parallel with floppy disk stores (on a prepared market). This greatly increases the storage capacity of mini- and microcomputers.

It can be seen from the foregoing that Winchester stores can be developed and manufactured primarily by firms which have the special technology for and years of experience in manufacture of floppy disk drives and magnetic disks. The experts of the Hungarian Optical Works also expect developmental and commercial successes from the Winchester stores. But it is too early to speak of results.

We wish them good work and much success in realizing the plans to follow the world level.

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POSTAL LICENSING OF DATA TRANSFER EQUIPMENT

Budapest SZAMITASTECHNIKA in Hungarian Feb, Mar 82

[Feb 82, p 6]

[Text] At present the teletype and telephone network and the new line connected data network can be used to set up remote processing systems. On the data network Hungarian Posts provides all the equipment for data transmission between the interfaces of the terminals but on the telephone network it provides only the transmission medium for remote data processing systems and thus the subscriber must see to the line connection equipment as well as the terminals.

In accordance with Law II, 1964, concerning posts and telecommunications one can link to the telecommunications networks of the Hungarian Posts only equipment which has been tested by it and which is suitable from the viewpoint of telecommunications and technical security. Thus the line connection equipment (modems) to be used on the telephone network must be licensed.

The manufacturing or trading institutions and the user can request testing of the equipment. Requests for testing should be sent to the Postal Central Telegraph Office (PKTH), 18 Varoshaz u., Budapest V, mailing address 1368 Budapest, Pf 1.

The types pf postal classification are: individual license, temporary model license and model license. The individual license always applies only to the equipment tested and use according to a given mode. The Posts issues a temporary model license after testing a prototype. This license pertains only to the model tested and its purpose is to inform the manufacturer of the postal position prior to series manufacture. A model license can be requested only for products which are technologically identical and manufactured in series; the model license applies to all equipment of the same type and quality as the equipment tested. It is a condition for issuing a model license that the equipment tested meet the pertinent provisions of the CCITT, the postal requirements and the prescriptions pertaining to healthy and safe conduct of work.

The PKTH maintains a register of licensed equipment and can inform those interested about the use conditions fixed in the licenses.

We hope to fill a long felt gap by publishing in our present issue those units of domestic and foreign line connection equipment which can be used on the telephone network and which have a postal model license. In this way we would like to help experts setting up remote data processing systems to select the data transfer equipment. Thus the list does not contain equipment which is already obsolete or which cannot be obtained.

Hereafter we would like to make information on licensed line connection equipment a regular feature. We plan to publish a list once or twice a year--supplementing it with equipment licensed in the interim.

Line Connection Equipment Tested and Licensed by the Hungarian Posts

(Partial list, continuation in our next issue)

Model number; Manufacturing firm; Number of the model license; Transmission speed in bits per second; and How it can be used:

VT-60200; Videoton; VT-6-0040; 600/1200; in two and four line direct telephone links; in a connected telephone network with or without answering, with manual call initiation and manual or automatic call reception. The license is also applicable to the versions built in to the VT-56191 terminals and the VT-60291 or VT-60292 frames.

24 LSI; RACAL-MILGO; VT-6-0041; 1200/2400; in two and four line direct telephone links; in a connected telephone network. With LA III call handling equipment.

MPS 48; RACAL-MILGO; VT-6-0048; 4800/3200; in two and four line direct telephone links.

AM-1200; Orion; VT-6-0051; 600/1200; in two and four line direct telephone links; in a connected telephone network. The several members of the modem family are constructed as follows: AM-1200/E, without control channel or call answering; AM-1200/F, without control channel but with call answering; AM-1200/G, with control channel but without call answering; and AM-1200/H, with control channel and call answering.

AM-2400; Orion; VT-6-0057; 1200/2400; in two and four line direct telephone links. The license also applies to the AM-2400/F and the AM-2400/L versions, but in the latter case only to use in a local network.

VT-60300; Videoton; VT-6-0059; 1200/2400; in two and four line direct telephone links; in a connected telephone network with manual call initiation and manual call reception. The license does not apply to the multipoint operational mode provided by the modem.

VT-61400; Videoton; VT-A-0060; 600/1200/2400/4800/9600; in two or four line galvanic links.

TAM-601; TERTA; VT-5-0061; 600/1200; in two line direct telephone links; in a connected telephone network. Also with the TMM-600 monitor unit.

SEMA-TRANS 4802; TRT (French); VT-6-0063; 4800; in four line direct telephone links, in the duplex or semi-duplex operational mode; with manual compensating, without an answer channel.

3863/1; IBM; VT-6-0064; 1200/2400; in four line direct telephone links, in the point-point or multipoint operational mode. The equipment cannot operate with the V.26 modem.

TAM-201; TERTA; VT-2-0065; 200/300; in two line direct telephone links; in a connected telephone network, with the TMM-200 monitor unit also.

AM-12TD; Orion; VT-6-0066; 600/1200; a duplex modem prepared on the basis of the CCITT V.22 provisions. In the synchronous or start-stop operational mode. In two line direct telephone links; in a connected telephone network.

3864/1; IBM; VT-6-0067; 4800/2400; in four line direct telephone links, in the point-point or multipoint operational mode. Because of the modulation used it cannot cooperate with the V.27 modem.

[Mar 82, p 6]

[Text] In the previous issue of our journal we provided information on postal licensing of data transfer equipment.

This article could cover only a part of the line connection equipment licensed by the Hungarian Posts. The list was prepared on the basis of licenses issued up to 21 December 1981.

We would like to make this information a regular feature in the future. We plan to publish once or twice a year a list of newly-licensed equipment--depending on the number of licenses issued.

Line Connection Equipment Tested and Licensed by the Hungarian Posts

Model number; Manufacturing firm; Number of the model license; Transmission speed in bits per second; and How it can be used:

2200/24; RACAL-MILGO; VT-6-009; 1200/2400; in four line direct telephone links.

SZAM-32; MTA SZTAKI; VT-6-0022, maximum 3200; in two and four line direct telephone links; in a connected telephone network. It cannot operate with other types of line connectors or with terminals where there is a relationship between the loading factor of the time signal and/or speed.

S.8351; Siemens; VT-A-0025; 1200/2400/4800; in two and four line galvanic links. Can be operated at a speed of 9,600 bits per second in a four line link up to a circuit distance of 10 kilometers also.

TAM-200; TERTA; VT-2-0026; 200; in two line direct telephone links; in a connected telephone network.

TAM-600; TERTA; VT-2-0027; 600/1200; in two line direct telephone links; in a connected telephone network.

GH-2052; ITT-SRT; VT-6-0028; 600/1200; in two and four line direct telephone links; in a connected telephone network. The modem does not meet the CCITT prescriptions in every respect and so can be operated in a connected network only under definite conditions.

GH-2054; ITT-SRT; VT-6-0029; 1200/2400; in two and four line direct telephone links; in a connected telephone network. The modem does not meet the CCITT prescriptions in every respect and so can be operated in a connected network only under definite conditions.

FM-200; VILATI; VT-2-0030; 200; in two line direct telephone links.

5979; IBM; VT-A-0032; 2400/4800/9600; in four line galvanic links.

3872; IBM; VT-6-0033; 1200/2400; in two and four line direct telephone links.

SEMA-TRANS 1203; TRT (French); VT-6-0049; 600/1200; in two and four line direct telephone links; in a connected telephone network with manual call initiation and manual call reception.

SEMA-TRANS 1001; TRT (French); VT-6-0050; 1200/2400/4800/9600/19200/38400; in two and four line galvanic links.

MK-600; MIKI; VT-6-0053; 600-75; in two or four line direct telephone links. A simplex modem providing transmission on a 600 baud data channel and reception on a 75 baud return channel. The license applies to the modem card with the condition that it can be used only in telemechanical equipment manufactured by the Instrument Industry Research Institute (MIKI). To get authorization for putting it into operation the user must give the Posts the method of use.

MK-74; MIKI; VT-6-0054; 75/600; a simplex modem providing transmission on a 75 baud return channel and reception on a 600 baud data channel. The conditions for use are the same as those for the MK-600.

26 LSI; RACAL-MILGO; VT-6-0070; 1200/2400; in two and four line direct telephone links, in the point-point or multipoint operational mode, with a return channel with CCITT B type modulation. A RACAL-MILGO VA-100 speech adapter can be connected to the modem also.

8984
CSO: 2502/79

DRILLING INSTALLATION DEVELOPED FOR USE AT 10,000 METERS

Bucharest STIINTA SI TEHNICA in Romanian No 1, Jan 82 p 10

/Article by Dr Constantin Nedelcu/

/Text/ In Nicolae Ceausescu's speech on Romania's socioeconomic development in the 1981-1985 Five-Year Plan he mentions, among other things, that "Firm measures must be taken to combine forces for rapid development of the technologies needed to exploit ores and other useful substances. The petroleum and mining industries have vital tasks to perform. We must intensify the effort to discover new petroleum and gas reserves and to exploit them, with special emphasis on increasing the degree of secondary recovery and providing the nation with more petroleum and gases." To this end the party leadership assigned the task of starting drillings to very great depths, down to 10,000 meters in the first stage and to 15,000 meters later on, which will reveal both accumulations of useful substances and geothermal sources. This kind of drilling is of considerable scientific importance, because one of the most important problems is to determine the presence of hydrocarbons at depths greater than 6,000 meters and the nature and conditions of their deposits, and also to investigate the structure of the earth's crust (phenomena of the origin and migration of metal-bearing deposits) and to study the waters at great depths.

In connection with the important task assigned the petroleum specialists, Dr Eng Viorel Cristea of the Bucharest IPCUP /Design and Research Institute for Petroleum Equipment/ was kind enough to describe to us the new F 800-DEC installation for depth drilling at 10,000 meters. Its design has already been drafted by the chief design engineer, Aurel Ocneanu of the IPCUP, and the Ploiesti 1 May Enterprise is to complete its construction this year.

After a number of tests in the United States (the depth record being 9,583 meters) it was concluded that drilling at such depths under Romanian conditions would be too exprensive and consequently unprofitable, but depth drilling installations for 10,000 meters comparable to the F 800-DEC have been built in the last 2 years. Of course drilling at great depths presents special problems of securing suitable technical characteristics for the equipment of the installation. The very high temperatures and pressures that are encountered are very important conditions, or those of corrosion (especially the hydrogen sulfide content) etc.

Among the F 800-Dec installation's chief technical characteristics we note the recommended depth interval between 8,000 and 10,000 meters, the maximum work load at the hook of 800 tf, the entry power in the winch of 4,500 hp, and the maximum traction on the cable at the drum of 7,500 kgf.

In the driving mechanism of its main equipment the F 800-DEC is provided with direct-current electric motors, control by thyristors and feeding from a small alternating-current power plant, as well as four generating sets powered by 2,500 hp diesel engines. The installation also permits feeding from the alternating-current network. Moreover the new installation will be of the decentralized type, such equipment as the winch, the mud pumps and the rotary table being powered separately from their own direct-current electric motors. This makes the said equipment entirely independent and permits convenient arrangements for it at a worksite.

The F 800-DEC installation is designed for superior performances in drilling. Note that the concept of a drilling installation has been interpreted in a much broader sense, so that a number of elements are included that are important to depth drilling under any conditions, like installations to prevent gushers, an installation to cement the wells, a complete set of spare parts and devices essential to drilling, equipment to measure the drilling parameters, and mechanization devices.

A number of major problems arose in designing the new installation in connection with the power consumption of the selected measure. A diesel-electric drive with a small alternating-current power plant was chosen, in keeping with the world trend. That driving mechanism is the most economical one for depth-drilling installations because the electric power is transmitted to the bars of the small power plant, with a minimum consumption of fuel in the diesel engines. The fact that the auxiliary consumers (electric compressors, electric pumps, the lighting installation etc.) are also fed from the bars of the power plant also helps to save fuel.

The 6,800 kw capacity of the small power plant meets all the drilling requirements.

The drilling installation properly speaking takes up a modest proportion (21.3 percent) of the investment necessary to dig a well to a depth of 10,000 meters, as compared with the total value of the main groups of equipment (drilling bit 4.6 percent, production equipment 4.5 percent, drill collars and drive bars 5.8 percent, tools for drilling, casing and production 13.5 percent, installation to prevent gushers 11 percent, equipment for geophysical investigation and boring 20.5 percent, etc.). Note that except for the last group, of the equipment for geophysical investigation and boring, the total weight of the other groups of equipment is 4,700 tons including the installation properly speaking, which weighs 1,860 tons. Note also that the total value represented by digging a well is about 500 million lei.

Construction of this important installation, which will permit intensified exploitation and will lead to the discovery of new petroleum and gas reserves, is being aided by several institutions in addition to the IPCUP (ICPE /Research and Design Institute for the Electrotechnical Institute/, Electroputere Center for Research, Design and Technological Engineering, Resita Institute for Hydropower Equipment, etc.), among whose specialists we mention Engineers Iulian Gradisteanu, Virgil Jugureanu, Valentin Pele and Ioan Ramboltz and Technician Paul Martinescu.

5186
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END

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13 JULY 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 748

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EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 748

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CEMA COLLABORATION IN BIOPHYSICS

Budapest MAGYAR TUDOMANY in Hungarian No 4, Apr 82 pp 297-301

[Text] By the 1960's schools of biophysics had developed in the majority of socialist and information exchange has intensified between scientists of those countries. In addition it was evident that equal, up-to-date conditions for accurate instrumental research could not be created everywhere. Therefore, if we wanted to pursue research according to the intrinsic logic of developing science and its practical up to date needs and if we wanted to be in the forefront of research in the world and produce internationally acceptable data, we had to sensible use the intellectual capacities and different levels of instrumentation of various countries. With this understanding in mind at the end of the 1960's, scientists of friendly countries decided to unite their possibilities within an organized framework in order to stimulate biophysical research. As a result of their initiative the Biophysical Collaboration was formed in 1971 within the CEMA framework with the participation of 8 socialist countries--Bulgaria, Czechoslovakia, Poland, Hungary, Mongolia, German Democratic Republic, Romania and the Soviet Union. In 1973 Yugoslavia joined the agreement of collaboration.

On the anniversary, the Council of Representatives of the Biophysical Collaboration of CEMA organized a meeting in which the jointly achieved results of the past 10 years were presented. This was combined with a scientific symposium, an anniversary publication and an exhibit of instruments. The host was the Biophysical Institute of the Biological Center of the Academy in Pushcina which employs about 1,200 people and is the world's largest biophysical research institute, and at the same time takes care of coordinating the collaboration center's tasks.

The Delegates' Council

The highest organ of the collaboration with a decision making power is the Delegates' Council in which each country has an accredited representative. This organization generally meets once a year, but if necessary even more often. The meetings are held in turns in participating countries. Two meetings were held in Hungary, in 1974 in Budapest and in 1980 in the Biological Center in Szeged. The meetings are attended by the accredited representatives, experts of the member countries, the leader of the Coordinating Center and his co-workers as well as by the co-workers of the CEMA

Secretariat. The meetings of the Delegates' Council are the highest democratic forums which develop the program of the collaboration and coordinate various joint activities. Moreover, a scientific symposium covering one of the subjects of the cooperation accompanies each meeting of the council.

Program of cooperation

a) Research Program for 1971-75

The Delegates' Council adopted five major directions of research as a program for the first five years' period, between 1971-75. This program was based upon suggestions from experts on traditions in biophysics of the individual countries as well as new scientific requirements.

Within the framework of the first major direction "Biophysical basis of regulation in biological systems" they studied laws of molecular events within the living organism. They investigated the structure and function of biologically important macromolecules, proteins and nucleic acids, primary events in the transformation of energy derived from the sun during photosynthesis and developed theoretical models for the interpretation of these laws. They clarified many characteristics of the intra- and inetmolecular interaction of biological macromolecules and macromolecular complexes.

As a separate main direction (second main direction) they emphasized the problem entitled "Molecular mechanism and energetics of muscular contradiction." Within this topic large scale investigations are being performed with regard to fundamental phenomena in the functioning of striated and smooth muscles as well as the mechanism of an abnormal heart function and its therapy.

The third main direction provides data for the clarification of "The physicochemical and energy basis of membrane function." Within this main direction besides basic research in determining the laws of bioelectric potential generation, programs of practical significance have also a large role. Among these one should mention the biological production of energy and studies on the effect of drugs (primarily antibiotics) at the membrane level.

The fourth main direction of the collaboration promotes the "Automation of biological research." The collaborating experts' goal is on the one hand automation of measurements of various biological phenomena, but also the development and production of new equipment; on the other hand they developed new methods for processing data with biological information.

The title of the fifth main direction is "Effect of physical factors on biological systems and characterization of the biophysical basis of their molecular and cellular effects." These studies are primarily oriented towards investigations of the effect of ionizing radiation; the analysis of the effect exerted on an irradiated living organism and studies on changes in enzyme kinetics. Significant research is going on in the area of damage caused by UV irradiation on the genetic level.

The collaboration had 22 program items and 28 subitems in the five main direction of its program for the first five years. Eighty-three institutes participated in the realization of the program. The collaboration fulfilled the hopes attached to it. A constructive contact was formed between researchers, the really collaborative work was more frequent, efficacy of research has increased due to labor division and the availability of some unique instruments owned by certain countries only.

b) Long Range Biophysical Predictions and Characteristics of the 1976-80 Collaboration.

In preparing the 1976-80 plan the Delegates' Council has requested an international experts' committee to prepara a prognosis for the development of biophysical research until 1990. By taking into consideration international trends, the work was completed in 1974. The next 5-year plan of the biophysical collaboration was developed by keeping in mind the suggestions of the predictions. The emphasis of the main directions remained the same, the number of program items was 16 and that of subitems 44. The number of participating institutes was 121. For the benefit of operational coordination of research, coordinators were assigned for the five main directions. Coordination of the second main direction was assigned to Hungary. In the collaboration research on muscle biophysics is compiled by the Biophysical Institute of the Medical School in Pecs and the coordinator of the main direction is Joseph Tigyi, full member of the Hungarian Academy of Sciences. The coordinators analyzed the merits of the work in progress of the main direction. The results were reported by the participants on biannually organized meetings of the experts, on symposia, round table discussions and poster presentations. During these meetings the researchers discussed organizational problems and various suggestions and they also prepared the work plan for the next time schedule for the problems of the main directions. Projects in which there was no actual joint research were dropped from the work plans of the collaboration.

During the 1976-80 period three categories of collaboration evolved. In category A projects were completed following strict criteria within the frame of a bilateral contract. Such contracts were signed by institutes and enterprises engaged in developing scientific-technical instrumentation, generally with the common goal to develop instrumentation. The majority of research was done in category B. The collaborating research organizations signed an interinstitutional collaborative work plan which, besides the common project contained also terms for financing and plans for exchange of scientists. The work plan was realized with the use of internal financial possibilities of participating institutes. In category C, connections not fully developed yet were dealt with, primarily via information exchange.

c) 1981-85: Intensive Continuation of the Collaboration

Nine countries and 143 research institutes are participating with almost 500 researchers in the 1981-85 collaborative plan. Eighteen Hungarian institutes--all of nation's significant biophysical research institutes--are participating in the collaboration. (The institutes are under the control of 3 higher

authorities, the Hungarian Academy of Sciences, Department of Health and Department of Education. The Biophysical Collaboration is being supervised by the Hungarian Academy of Sciences.) The participation of Hungarian researchers is significant in each of the main directions of the research program. The collaborative program will be enlarged by a new sixth main direction: investigation of the biological role of water. In 1980 the biophysical research prognoses were supplemented by projections until the year 2000.

Results

We are going to mention only a few of the results: six bit new instruments were developed by the researchers of socialist countries and seven patents were registered. For example they made the Morphoquant, automatic micro-object analyzer with which the formed elements of blood, chromosomes, cell tissues and various dispersion systems can be examined. The instrument was patented in the U.S., Great Britain, West Germany and France and it is manufactured by Karl Zeiss (Jena). They produced a new raw material (polyvalent virulent ohages) for the pharmaceutical industry. A vaccine against staphylococci was obtained by this method and pharmacological and clinical tests were successful. It is useful with good results in acute and chronic diseases and for prophylactic purposes as well. Successful testing of the production of artificial blood is also under way.

The results of basic research are reported in more than 1,550 scientific publications and two monographs printed in 10 years. Most of the publications have appeared in the official journal of the collaboration, "Studia Biophsica."

Planning, Organization of Research

The practical significance of the biophysical program and the efficacy of the joint work is increased by the adoption of a new planning system in the last ten years. Firstly, for practical purposes the realization of concrete, complex tasks and preparation of projects, was assumed by those collectives which are the most qualified in a particular area. Presently two projects are underway, the "Electric field of the heart" and "Biophotometry." The project entitled "Electric field of the heart" will create a new biophysically established complex system of criteria for automated EKG diagnostics. "Biophotometry" is establishing a system of measurements for the evaluation of the biological effect of optical radiation and instruments suitable for mass production. Hungarian scientists are participating in the realization of both projects.

Proof of a more effective organization of research is the formation of base laboratories. In the German Democratic Republic a base laboratory was started which made available complex measuring and data analyzing ESR spectroscopic methods as well as low angle X-ray diffraction methods. In the near future a base laboratory will be established in the Biophysical Institute of Pushcina to comrepehensively investigate biologically active molecules and to reconstruct their steric configuration. To complete the current research tasks the base laboratories have a minimal support personnel and a temporary

international At the anniversary meeting Hungarian and German researchers gave a very successful presentation of a project--the spin labelling of biological macromolecules--performed under the above mentioned circumstances. Current information about the existence of base laboratories in different countries, the thematic and methodological profiles of institutes participating in the biophysical collaboration, their research possibilities and organizational structure, can be obtained from the periodically published and revised Informational Guide, which is put together by the Coordination Center.

Biophysical Training of Cadres in CEMA Member Countries.

Finally it is worth mentioning that the countries participating in the collaboration came together from time to time to discuss training of cadres and their continued education. In 1973 a meeting of experts convened to analyze in detail this problem. This material was published in a special volume. It contained the biophysics curricula and requirements at the universities of member countries and informed about the differences in qualifying systems. The desire was expressed to standardize studies and to have the same requirements for the theoretical studies of biophysicists in the accreditation process. Unfortunately, in this area we are not very successful since the training and continuing education of experts if the responsibility of several higher authorities; the Council of Representatives has sent its recommendations to the CEMA Secretariat.

CEMA Biophysical Cooperation promotes the professional development of young cadres by organizing courses and symposia. They organize courses yearly on several subjects. By now they have become traditional and are very popular. Such is, for example, the course on radiation biology organized in Czechoslovakia, and the winter course in Poland on membrane biophysics.

Difficulties of the Cooperation

At the beginning the cooperation encountered numerous problems which were more or less solved over the years. These difficulties were primarily organizational and administrative in nature and did not affect research itself. The introduction of the new collaborative forms accompanied by problems associated with the old, rigid administration; to eliminate these serious efforts are needed since it effects legal and financial systems of the various countries.

In many countries, as well as ours the exchange of cadres, was a matter of concern since without this the realization of common research would be impossible. There were difficulties in assuring travel funds with the highest authorities, because foreign trips necessary to realize the program had to be coordinated by someone. In each country such problems were solved differently. In the USSR and Poland a separate budget was assured from central state sources. Distribution of these funds is decided by the accredited representative of the country. According to present practice in Hungary, prolonged stays are financed by authorities of the interested institute, while the

expenses for scientific meetings are covered by the supervisory body of the collaboration, the Hungarian Academy of Sciences.

A recurrent problem of the collaboration has been the question of extent of authority of the accredited representatives. It was evident that the joint work could be more efficient and organizationally improved only if partners countries kept in touch through competent accredited representatives with proper jurisdictional scopes. For the current period of the collaboration this problem has been solved in almost every country.

The introduction of contract supported research has also caused serious organizational and legal problems. Contracts with accurate timing assure the completion of various phases of the work by the partners. Generally, such contracts cannot be applied to basic research. Therefore, legal and financial conditions had to be worked out which could be applied to contracts for basic research. There were also difficulties in preparing further development of existing research contracts. Adequate forms had to be found for the cooperation of research institutes, manufacturing companies, organs of foreign trade and they had to be accommodated to the legal and financial terms of member countries. Even in the current phase the CEMA Secretariat and the respective higher authorities of member countries have several responsibilities with regard to using research and development, and production results, i.e., to further the practical application of achieved results.

Despite the existing problems participants of the anniversary meeting in Pushcina closed with satisfaction the first decade of the Biophysical Collaboration. The Hungarian biophysical researchers were specially honored in that Tigyi Joseph academician was elected in the first foreigner honorary citizen of Pushcina, according to the diploma "...for spreading the achieve-ent ments of Soviet biology in Hungary and other countries, and for his relentless and fruitful work in the Representatives' Council in the area of 'biophysical research' of the CEMA countries and Yugoslavia.

On the basis of the last decade's theoretical and practical results we have every assurance that research of the coming years will enrich science with useful results and will also enrich--directly or indirectly--the economies of our countries.

9968
CSO: 2502/80

PRINTED CIRCUITS TESTING MACHINE DEVELOPED

Sofia TEKHNICHESKO DELO in Bulgarian 15 May 82 p 5

[Article by Engineer Yulian Danchev: "Automatic Testing and Electrical Checking of Printed Circuits"]

[Text] The Development and Applications Center at the Ruse Printed Circuits Plant has developed a system of hard- and software for ATEK [avtomatichno testvane i elektricheski kontrol; automatic testing and electrical checking] of printed circuits. Originated in order to meet the needs of the plant's basic production, ATEK has proved necessary for all plants producing computer equipment, as well as for proprietors of computer centers. With its help circuit checking and defect detection are significantly speeded up and, what is most important, can be assigned to personnel without special technical skill. ATEK operators are exempt from any obligation to know or use the complex circuitry of the boards or the diagnostic lists.

ATEK consists of the basic IZOT 1009S model and three additional modifications--IZOT 1010S, 1011S and 1012S with which the capabilities of the system are extraordinarily expanded and universalized. The IZOT 1009S takes the form of a panel with a video terminal, testing sockets and built-in electronics. It is designed for testing printed circuits with a small, medium and great degree of integration. With its help testing is done under "good/no good" and "dialog diagnostics" conditions. For the latter case the system is supplied with an "intelligent" clip and tester. The package consists, besides, of a processor with a 32-kilobyte memory, a minidisk storage and a set of testing and applied programs.

The IZOT 1010S, intended for real-time testing of digital circuits, is a modification of the basic model. Not only does it include all the capabilities of the IZOT 1009S, it has a program-controlled clock oscillator and a multiphase clock system. With their help, real operating conditions of the circuits can be simulated. In this sense, whereas, figuratively speaking, static circuit testing and checking is possible with the basic model, with the IZOT 1010S this is now done under dynamic conditions.

Further expansion of the ATEK functional capabilities has been achieved by the IZOT 1011S modification. It is intended for testing digital-to-analog circuits by the

performance of parametric tests, with the possibility of treating each circuit as digital, analog and digital-to-analog. What is new here about the hardware is a 32-point matrix module and a 24-outlet instrument matrix. The package consists, besides, of three standard instruments: a digital voltmeter, a functional generator and a frequency meter.

An important advantage of ATEK is the fact that it has its own well-developed automatic system for the generation of test programs, realized by the IZOT 1012S. Its operation consists in creating a mathematical model of the real printed circuit. This is done by inputting coded data not only about the logic circuit of the board, but also about the integrated circuits used therein. These data are withdrawn from the program library with which the system is supplied. Therein are recorded the data for all the integrated circuits used in the computer equipment produced by the IZOT State Economic Trust. After it creates the mathematical model, the system generates the necessary sequence of test pulses, including a complete test program. This means that the users do not have to be supplied in advance with test programs for all their boards because they can compile them themselves with the help of the IZOT 1012S.

It is of great importance that signal propagation time through the microcircuits of the board can be simulated with ATEK. This is especially important since it makes it possible to allow for the effects of "competition" between pulses. As a result of capacitive and inductive influences, their propagation through the elements of the board takes place in a time that differs in practice from the rated time, which leads to logic errors and ultimately to improper functioning of the printed circuit despite its technical serviceability.

The IZOT 1012S configuration includes a processor with a 96-kilobyte memory, a video terminal, an engineering panel, storages on mini- and floppy disks, and a printer.

In respect of its functional capabilities and the improvement of its technical base, the ATEK system is the first of its kind produced in the CEMA-member countries and has indicators on a par with the best models in the world. The original principles and circuitry solutions which are incorporated in its basis are protected by patents.

6474
CSO: 2202/12

BRIEFS

NEW LASER DESCRIBED--Scientific Associate and Candidate of Physical Sciences Nikola Subotinov, Scientific Associate Petur Telbizov and Scientific Associate Nikolav Vuchkov of the Consolidated Physics Center of the Bulgarian Academy of Sciences have developed a copper bromide-vapor laser. The concentration of copper atoms is obtained by electronic dissociation of copper bromide molecules at a temperature of the active medium of about 400 degrees. In this manner the operating temperature is reduced by more than 1000 degrees as compared with a pure copper laser. Thus the design of the laser head is simplified and the possibility of incorporating it in various laser instruments is increased. The equipment operates in a pulse regime (repetition rate from 5 to 20 kHz). Average output power varies from 0.5 to 10 watts, with the laser usable in medicine as a bloodless scalpel at powers over 4 watts. It operates with two wavelengths: 510.6 and 578.2 nm. The laser can be used successfully in physics, chemistry, biology, etc. It is suitable for laser radar and rangefinders, and its high amplification factor opens up possibilities of creating a laser microscope. [Text] [Sofia TEKHNICHESKO DELO in Bulgarian 15 May 82 p 5] 6474

CSO: 2202/12

SCIENTISTS DISCUSS BIOTECHNOLOGY RESEARCH, APPLICATIONS

East Berlin SPECTRUM in German Mar 1981 pp 6-11

/Roundtable discussion by SPECTRUM staff members Hildegard Hesse and Horst Hoffmann with Guenter Pasternak, member, GDR Academy of Sciences and director, Research Center for Molecular Biology and Medicine; Sinaida Rosenthal, member, GDR Academy of Sciences and staff member, Central Institute for Molecular Biology; Manfred Ringpfeil, corresponding member, GDR Academy of Sciences and director, Institute for Technical Chemistry; Prof Dr Friedrich Bergter, Central Institute for Microbiology and Experimental Therapy; Prof Dr Hartmuth Franz, MD, director, State Institute for Immunization Preparations and Nutrient Media; and Dr Dietrich Meyer, Institute for Technical Microbiology of the Ministry for the Chemical Industry/

/Text/ We often observe, at the limits of a number of scientific areas, advances in knowledge that occasionally give rise to new scientific fields with an intrinsic profile. One such field is biotechnology which is currently developing at the interfaces between medicine, biology, chemistry and technology. This field is not linked solely to concrete tasks for research and application; its development also poses many unsolved problems.

SPECTRUM: Could we briefly characterize the science of biotechnology?

PROF PASTERNAK: As the name itself indicates, biotechnology encompasses the research and application of biological principles and processes, and the conversion of these results with the help of technological procedures. The goal of industrial production is always pursued in this connection. The basis of biotechnology is the production of biomasses, enzymes and certain substances by microorganisms, and plant or animal cells. This also includes microorganisms and cells

in which desired production properties and functions have been obtained artificially by genetic manipulation or gene transfer. Biotechnology has been of economic importance in the food industry for centuries. I need mention only the production of bakers' yeast, beer and wine. However, the production of protein from nonconventional carbon sources, the production of specific enzymes, antibiotics and amino acids, and the effective conversion of natural substances with biotechnological processes have only been on the agenda in this century and especially at the present time. Biotechnology is expected to make major contributions to the solution of energy, raw material and nutrition problems in health and environmental maintenance.

SPECTRUM: It is therefore not exaggerated to have great hopes for the results of biotechnology?

PROF ROSENTHAL: Definitely not. It is generally accepted that biology will play an important part in future scientific and technical progress. What is this based on? In my opinion, there are two developments: First, in recent decades, biology has advanced up to the molecular level of the life processes and provided explanations of scientific laws, especially in connection with the chemistry of cell metabolism, protein synthesis, and heredity and structuring of cellular organelles. Second, there is just at the present time, an increased effort to integrate these molecular processes into more extensive processes.

PROF RINGPFEIL: The economic questions previously mentioned by Comrade Pasternak become more important in the light of these events on the scientific level. What is a more obvious step than finding new technical solutions for the production of raw materials, energy, food and for environmental measures based on scientifically detected possibilities? That is why we are at this time establishing biotechnology as a scientific field, from the effects of which on social practice -- as it was once designated by Professor Klare -- we expect much and hope for even more.

DR MEYER: This should be strongly emphasized, in this case in terms of industry. Industry is justified in expecting basic research to provide knowledge that will make it possible to manufacture new products, and to develop new procedures or use existing ones in a more economical manner. Here, research and practice must make use of domestic resources in the overall social interest. I am thinking primarily of agricultural and forestry raw materials and waste products. To mention only a few examples, this would apply to mass products such as protein and ethanol and to the products of highly refined production processes such as antibiotics, extracellular and

intracellular enzymes and amino acids. On this basis, the results and processes of biotechnology will be implemented in the chemical industry, agriculture and the food industry. This will put us in a position to achieve further development in the structures of these areas and to increase production effectiveness. In this connection, basic research in biotechnology must isolate those processes that make use of the advantages of the effect and substrate specificity of biological processes, and thereby create economic alternatives to chemical processes. This encompasses biosynthetic processes as they are used, e.g. in the Peoples' Republic of Hungary, in the total utilization of corn. This involves chemical, microbiological and biochemical technology for the production of protein, ethanol, fructose and a number of basic chemicals.

SPECTRUM: Biotechnology and the results related to it have received sensational coverage in the Western Press.....

PROF RINGPFEIL: ....this is not surprising if we consider the nature of these publications. Attractive situations like this are used, or better "milked" by the capitalist tabloid press. Objective relationships are exaggerated and efforts that should be taken seriously are praised to the skies. However, our knowledge and experience are perfectly adequate for us to be able to make distinctions. It is clear that large investments are being made in bioscience and biotechnology all over the world. But it is equally clear that not all the problems posed by social practice can be solved with biotechnological methods. The penetration of biological action principles in the material-conversion industry is therefore governed substantially by how and in what areas the requirements of industry can be fulfilled. This undoubtedly necessitates a very complex mode of consideration, which we must develop. Sensational reports are of no help here.

PROF PASTERNAK: To follow this, I would like to make some comments on the strategy of our research even if there are many who take it for a given. In biotechnological assignments, our efforts are of course also geared primarily to economic needs. Our economists deal with these problems and contribute in setting up essentially needed elements in a state that permits conversion to production. We will not work in full scope in biotechnology and its bioscientific fundamentals in line with our research potential; priorities must be established. To accomplish this, we are in close contact with our practice partners, with whom we are already beginning cooperative work in the conceptual phase. However, this course does not mean that we shall direct our efforts exclusively to the demands of industry. The Academy, together with higher education, is jointly responsible for basic research in the

GDR. This responsibility is fulfilled in that our scientists are making advances into new territory at the limits of our present knowledge, even though possibilities for the application of these are not immediately apparent.

SPECTRUM: Biotechnology is therefore also substantially technological science. What does this mean to the construction of scientific apparatus?

PROF PASTERNAK: Application of results presupposes that appropriate installations, apparatus and measurement, control and regulatory technology are available. Automation of processes has made considerable progress as a result of the use of microelectronics, and contributed to augmentation of effectiveness in production. It goes without saying that research and development in this area must keep pace with bioscientific research and vice versa. However, modern equipment of laboratories with materials and apparatus, and pure, biological and radioactive chemicals that are adequate for all needs are also an important prerequisite for the performance of assignments. We have therefore decided to devote greater attention to these problems in order to gain first hand access to important aids via the development of scientific instrument construction in the Institutes and biochemical development and production in special techniques. Original contributions can be expected above all if new methods and technologies are more rapidly accessible to us than to other groups.

PROF BERGTER: Just as the chemistry and physics of the eighteenth and nineteenth centuries constituted a base for the development of important technology, biological research in this century is a base for biotechnology. I would say that there was technology, and even biotechnology, in a very early stage of human society. Professor Pasternak mentioned examples of this in his introductory remarks. However, there is biotechnology only when biology has established the necessary base. Development of biotechnology was greatly stimulated by the production of antibiotics which started after the Second World War. Improvements in technology and cellular performance were undertaken for many years, especially in connection with the classic antibiotics. The Central Institute for Microbiology and Experimental Therapy in Jena participated in increasing performance by carrying out genetic, biochemical and biotechnological studies, but also by seeking new antibiotics to close gaps in human and veterinary medicine. In collaboration with the pharmaceutical industry, the macrolid antibiotic turimycin was developed to the point where an injection product which is indispensable for industrial animal production was made available to veterinarians in commemoration of the Tenth Party Congress.

PROF ROSENTHAL: A few comments on the problem of historical dimensions of scientific development. The beginning of this century was characterized by important increases in knowledge in the area of microbiology, which was translated into modern fermentation technology, the potential of which has still not been exhausted. With regard to our progress in knowledge during the past fifty years, we speak of two revolutions in the molecular-oriented biosciences: the enzyme revolution and, in the past thirty years, the revolution in our knowledge on genetic substances. Knowledge in both areas permitted development in the direction of manipulating these processes. The most recent stage in this development is genetic engineering which has created such a furor. The rapid conversion of basic data into practical goals is made possible by the fact that conventional biotechnological methods exist, e.g. microbial fermentation techniques. In addition to this, there are the new possibilities for specific manipulation of microorganisms. There has, so to speak, been a marriage between the existing technological methods and the new knowledge.

PROF PASTERNAK: With genetic technology, we have of course reached a principle solution that enables us to act in many production areas. To come back to the remark regarding the western press media, I think this explains the great interest of concerns.

PROF RINGPFEIL: We should take into account that genetic technology -- I will leave open to question whether or not this is an appropriate designation -- is part of biotechnology. As is the case with the introduction of any other advance in biotechnical production processes, implementation of genetic technology necessitates that it be looked at in its totality with the aid of the required scientific, technical and economic methods. This is the working method of biotechnology, as of every other technology. We can learn a lot here from chemical technology which is already developed.

PROF ROSENTHAL: But there are also specific biological advantages.

PROF RINGPFEIL: There is no doubt about that. These constitute the specific nature of biotechnical processes and they substantiate the need for biotechnology in addition to other technologies such as, e.g. chemical technology. For example, the specific advantages of biolotical processes over chemical ones lie in their marked synthesis specificity, in the use of heterogeneous and diluted raw materials that were not accessible to date and in the accumulation of substances to protect against natural decreases in concentration. However, these advantages also have disadvantageous effects. Hence, in many microbial processes, energy for the synthesis of new molecules is obtained from the raw material molecule. In other words, while the processes require only a small addition of energy from the

outside, they convert up to 50 percent of the available organic carbon into carbon dioxide and from this produce a considerable quantity of heat which results in an unfavorably low temperature level. It is our intention to make the best possible use of the advantages and to limit the disadvantages as much as possible.

PROF FRANZ: The quantity of products that can be manufactured by biotechnological methods will in the future probably also range from fractions of a gram to many tons. In my opinion, this must definitely be considered. Economic factors play a totally different part in the production of tons of important starting materials than in obtaining potential substances for the protection of health, i.e. for the diagnosis, prevention or therapy of certain diseases. The development of biotechnology poses many new tasks in this respect as well.

SPECTRUM: Where is the main potential for biotechnological research in the GDR?

PROF RINGPFEIL: The GDR has available an entire series of workable potentials in biotechnology. For example, our Academy decided to undertake an outline of basic potentials very early, at a time when the idea of biotechnology in the current sense did not even exist. It is not exaggerated to say that, as a result of this early involvement, we were able to participate in determining the development of this scientific area. Technical microbiology studies performed since the beginning of the fifties by Academy members Leibnitz and Rieche, and also by Hans Knoells, who established antibiotic production in the GDR, have constituted a major portion of this involvement. Today, in the GDR numerous scientific, educational and industrial installations with considerable potentials are active in the area of biotechnological research and development. I hope it will not be considered boasting if I put at the top of the list the Academic Institute for Technical Chemistry which, since 1969, has had its 400 associates working exclusively in the field of biotechnology. I should also like to mention the academic industrial complex of technical microbiology in which the chemical plant construction combine, the Institute for Technical Microbiology of the Ministry for Chemical Industry and our Institute are jointly solving biotechnological tasks.

PROF PASTERNAK: Perhaps we should emphasize once again that the development of biotechnology represents an extremely complex task. At the Research Center for Molecular Biology and Medicine, we are engaged in a number of research projects that involve tasks in genetic engineering, as well as in enzymology, immunology, antibiotic production, nutrition, and plant and animal cell and tissue culture. These can all be classified

as biotechnological research in the broader sense. The potential involved is very extensive; it consists of many groups from almost all of the institutes of the FZMM (Research Center for Molecular Biology and Medicine) and various higher education facilities. Coordination is effected via the bioscience program in cooperation and synchronization with Comrade Ringpfeil's sphere of responsibility.

SPECTRUM: Is industry sufficiently prepared to take over such complex solutions?

DR MEYER: Economic realization of these extensive research projects requires the further development of working cooperation among industrial installations, academic institutes and higher education. The working out of the next five-year plan provides a good opportunity for establishing the requisite steps. The Ministry for the Chemical Industry together with other guidance organs of our economy is charged with coordinating the development of biotechnical production in the GDR and cooperation with the RGW countries. The necessity for organizing complexes of this kind has been demonstrated using as an example the fermosin process for production of feed protein from diesel fuel. We are at this time just about to start operation of the large scale plant in PCK Schwedt. This experience must be applied to other technology, especially to the manufacture of highly refined products. I am thinking here, e.g. of the production of antibiotics and diagnostic enzymes, a product group which is equally important for maintaining the health of our citizens and for further increasing our country's export capacity.

PROF FRANZ: Perhaps I might mention another example here. At the Government Institute for Immune Preparations and Nutrient Media, we prepare more than 200 products that are very important for health protection in the GDR. We utilize the biotechnological procedures which to date have been considered conventional and classic. However, it is now important to have access to international developments as soon as possible. This applies in particular to the production of antibodies. At present, we obtain these chiefly from immunized animals (rabbits, goats, sheep). However, we hope that we can soon switch -- at least partially -- to hybrid technology. However, this cannot be attained without close cooperation with other work groups. We have therefore arranged with Prof Pasternak that associates from our Institute will be included in his research group in the preparatory phase. These will at first be scientists; technicians will also be included at a later time. We have similar contacts with Prof Ambrosius' group in Leipzig. We thus hope to be able to introduce a new variant of biotechnology at the proper time. The proper time will be when all

scientific preparations have been completed and the material and technical prerequisites have been established.

PROF ROSENTHAL: I feel that a number of tasks must be performed more quickly. Regardless of the area, new technology of this kind, which was mentioned here a number of times, always requires specific new methods, and these must not remain at the information research level for so long. They must be converted more rapidly. These methods must be made available in an intensified manner to scientists in the various fields of application. This means that, in addition to the research programs, there must be a training program. This may not be general; rather, it must be associated with the solution of specific conversion tasks.

PROF PASTERNAK: Our research center is prepared to undertake training and continuing education projects for particularly apt students as well as for scientists in industry-specific research, especially in the field of molecular biology/biochemistry where the method complex would be very greatly involved in genetic engineering. This would also provide ensurance of connections between universities and industry.

SPECTRUM: Does combine formation also entail advantages for cooperation in biotechnology?

PROF RINGPFEIL: There will be further development in the connection to industry to the extent that the combines include biotechnological tasks in their long-term developmental strategy and to the extent that they are prepared to perform a certain amount of basic research themselves. There are some very encouraging examples of this, i.e. the work of the chemical plant construction combine and the Schwedt petrochemical combine. However, there are still reservations here. Basic research can of course not have only short-term goals. It must also generate the spirit and strength for broad-ranging goals. This is the order of the day. It means that the attainment of long-term progress must be related to the skimming off of useful results in such a manner that both requirements can be fulfilled. I think this is the only way that we can meet the requirements ensuing from our Party's planned economic development and its rapid augmentation. Biotechnology can certainly contribute to this. The extent and duration of this contribution depend not least on our efforts, our wealth of ideas, our ability to cooperate and our resoluteness. The preliminary conditions are not so bad: We have capable, internationally recognized research potential. We have combines that have courageously undertaken new developments. There is proven cooperation in both the national and international sphere. And there is a broad gamut of microbiological and biochemical production in a whole series of industrial areas. A base exists on which we can continue building systematically.

PROF PASTERNAK: The party and government have continuously made available to us the means for comprehensive development of bioscientific basic research. We have traditional institutes where biotechnological research has for many years been part of the assignment spectrum. In this connection, I should like to mention the Central Institute for Microbiology and Experimental Therapy in Jena and the Central Institute for Nutrition in Potsdam-Rehbruecke. However, we also have new installations, such as the new laboratory facility that recently started operation at the Central Institute for Molecular Biology. Here, scientists are working on genetic engineering projects and creating the prerequisites for new technologies. In collaboration with the Central Institute for Genetics and Cultivated Plant Research in Gatersleben and the Institute for Plant Biochemistry in Halle, projects are under way dealing with the development of manipulated microoganisms for use in industrial production processes, manufacture of vaccines on the basis of new technologies, and working out of a preliminary course for cultivation research, all with the goal of increasing the yield in plant production. It is estimated that the economic profit expected in the future will be of considerable magnitude.

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HUNGARIAN RESEARCH AT DUBNA

Budapest MAGYAR TUDOMANY in Hungarian No 1, 1982 pp 5-13

[Text] The Joint Institute for Nuclear Research (JINR) of Dubna was established 25 years ago, in March 1956. For the anniversary, the Section of Mathematical and Physical Sciences organized a scientific session on 14 April 1981, in connection with the annual meeting of the academy. The series of lectures presented the work of Hungarian investigators at Dubna, illustrating the influence of the JINR on Hungarian scientific life. Of the reports given, we are presenting, with some condensing, the presentations of members Denes Berenyi and Dezos Kiss.

Investigations in Experimental Particle Physics

[Article by Dezso Kiss, corr. academ., dep. dir. of Central Research Institute of Physics]

The Joint Institute for Nuclear Research

The document concerning the establishment of the Joint Institute for Nuclear Research was signed in Moscow on 26 March 1956. Modern particle and nuclear physics research requires the construction of increasingly larger and more expensive accelerators, reactors and detectors, whose construction and maintenance expenses greatly exceed the capacity of the smaller countries. The mission of JINR is to provide opportunities for research in modern particle and nuclear physics for the physicists of the member states of the socialist camp.

At its establishment, the Dubna institute possessed two accelerators; one at that time was the highest energy accelerator (10 GeV)[1] in the world. The other was a 680-MeV energy synchrocyclotron, which could be used for investigations in nuclear physics. During the past 25 years, this arsenal was enlarged by several cyclotrons suitable for accelerating heavy ions and three pulsed reactors, unique in the world. During recent years, the 10-GeV synchrophasotron is being gradually adopted for the acceleration of high-energy heavy ions, which in many respects is uncharted territory, between particle physics and nuclear physics.

Internationally, Dubna was the first to enter this field. The synchrocyclotron is being rebuilt; it will resume operating in about a year. Meanwhile, the institute established a computer center, which possesses, in addition to two high-capacity American and Soviet computers, three intermediate-R40 and several dozen smaller computers (including several Hungarian ones).

The research staff of the Dubna institute amounts to 6,000 persons (increasing yearly by 60); of them 800 are scientific researchers, about half come from member states outside the Soviet Union. The institute receives a yearly capital investment of 30 million roubles and an operating budget of 16 million roubles. The 11 member states contribute to the support of the institute in proportion to their national income; our country pays 2.65 percent, which in absolute value amounts to 1.3 million roubles.[2] Since its creation, about 200 Hungarian specialists spent time at the Dubna institute for extended work of several years. As a general rule, about 50 Hungarian researchers are working at a given time at Dubna.

Research at the institute follows three main scientific directions: 1. particle physics, 2. nuclear physics, 3. physics of condensed systems.

In all of these areas intensive Hungarian-Dubna joint research work is in progress. In addition to these three main directions, Hungarian researchers have been and are working in several other fields outside the primary areas. In order to cover the whole range, without any claim of completeness, we would like to list some of these projects.

Joint Investigations outside the Main Research Areas

a) At the intersection of shell physics and nuclear physics, Hungarian investigators are working on two subjects in meson physics and chemistry. One of the subjects is the examination of the mechanism of the creation of deuterium-muon molecules. The muon molecules formed from hydrogen isotopes are of interest because of the nuclear fusion catalyzed by muons; they could acquire a practical importance. It has been proven theoretically and checked experimentally that the probability of the creation of the deuterium-muon molecule, which plays an important role in nuclear fusion, exhibits a resonance behavior at a certain temperature.

b) Investigations in nuclear chemistry also have a distinguished past at Dubna. With the cooperation of Hungarian chemists, the organic chemical reactions of the most difficult halogen atom, the unstable astatine (At_{85}), have been studied for decades. The astatine isotopes have been prepared with the help of the synchrocyclotron. It was found that astatine preserves its halogen character in formerly unknown organic chemical reactions.

c) Hungarian staff members also participate in electronic computer and program programming research; specifically they help to raise the overall level of

electronic and computer activities at JINR with the help of instruments manufactured in Hungary. For example, many TPA minicomputers developed at the Central Research Institute for Physics are used at the computer centers of the institute; there are many analyzers and several Videoton VT 1001 type computers used primarily for data processing, similarly designed at the Central Research Institute of Physics. There is a similar situation with the peripheral units. Among the terminals, the Videoton VT 340 type alphanumeric display is found most often at the large computer center of the institute; we encounter also the Sztaki GD 71 graphic displays. In addition to the hardware activity, significant programming software work is also in progress.

On the other hand, our investigators were greatly assisted by their access to to the large CDC 6500 computer at a time when we no longer had the ICT and the R40 computer was not yet available to us.

d) We are also carrying out joint measurements in the field of high-energy nuclear physics. We presented a review about them in the journal FIZIKAI SZEMLE.[3]

Experiments in Particle Physics

Without any claim for completeness, I would like to report briefly on the most important joint scientific investigations in particle physics during the past 25 years.

1. Collaboration on bubble chambers.

a) We started our participation in the particle physics investigations at Dubna in 1958. We participated in the study of the 6-10 GeV/c pulse π-meson interactions by means of nuclear emulsions, on the basis of our traditional experience with cosmic radiation.

b) The first collaboration with bubble chambers[4] involved the 24-liter propane chamber built in Dubna; in this experiment, we examined the properties of $\pi^- p$ elastic interactions in the above-mentioned energy range. This was followed by a study of this reaction in a larger, 1 meter propane chamber.

Since 1966, we participated, within the framework of the Dubna-Budapest-Warsaw collaboration, in the processing and evaluation of the pictures taken with the 24-liter filled xenon chamber. It is a special characteristic of bubble chambers filled with heavy liquids, and in particular of the xenon chambers, that--since they contain an element with a large order number--they are very well suited for the study of processes involving the creation of neutral particles.

Part of the experimental results has been included in the international table on the physical properties of particles ("the periodic system" of particle physics) compiled by Rosenfeld exhibiting good agreement with other experimental results. In addition, the experiment had important theoretical consequences: it led to the development of a new experimental model.

c) We also participated in the development of an automatic installation for the evaluation of bubble-chamber pictures.

d) Our longest and most important collaboration in the field of bubble chambers involved the two-meter propane chamber. We participated in this collaboration from 1970 to 1980. This was the first major international cooperation, in which nearly all socialist countries participated. Nearly 100 investigators from 10 to 13 particle physics laboratories worked on this project. We carried out the first experiment with the 40 GeV/c-pulse π^- meson beam of the Serpukhov accelerator.

Our first important result involved the determination of the average multiplicity of charged and neutral particles created in π^-p and π^-n interactions. At that time, this π^-meson energy was the largest in the world.

In addition to the results of many experiments, not only was such collaboration established among physicists of various laboratories, but a very fruitful relationship arose between the theoretical and experimental physicists--similarly at the international level.

In the second experiment the chamber was irradiated at the Dubna accelerator with 2-10 GeV/c/nucleon pulse, p, α, d, C particles, placing a tantalum disk in the chamber. This offered an opportunity to study the properties of nucleon-nucleon interactions. This again represents a little investigated area, and in spite of the many methodological problems, significant results have been obtained: determination of inelastic scattering; the average multiplicity of the obtained protons, the π^+ and π^- mesons, for various targets in the case of various primary particles. We do not plan to continue this investigation; our earlier participation may be considered a scouting excursion in the field of relativistic nuclear physics.

2. The RISZK (RISC) Experiment[5]

One of the first large installations--with the bubble chamber--in the course of the development of particle physics detectors was the so-called spark chamber. The operating principle of the spark chamber is quite simple. Metal wires are placed facing an electrode serving as a second electrode; we establish a high voltage between the two, creating a field strength of about 20 kV/cm. The chamber is filled with a mixture of helium-neon gas. The particles passing through the chamber ionize the gas atoms along their paths; the generated

electrons and positive ions are accelerated by the electrostatic field, creating an avalanche effect, which ultimately manifests itself in the form of the spark. The series of sparks reflects with high fidelity the track of the particle that passed through, and thus it can be used to determine the trajectory--and in a magnetic field, the pulse--of the particle.

The shortcoming of the spark chamber is due to the long waiting periods (several microseconds) until the generated ions leave the area of the chamber, allowing the chamber to determine other particles. We solved this problem in the following manner: We apply the high voltage on the chamber not continuously but in a pulsed manner. (We switch off the high voltage from the armature about 20 nsec after the primary ionization event). This stops the evolution of the spark about to be created, and only streamers are formed. This presents the advantage that much fewer ions are formed; they can be removed very rapidly from the chamber, enabling the chamber to record a larger number of particles (the dead time is reduced). At the same time, because the dimensions of the streamers are smaller than that of the spark, the coordinates are more precisely determined. Its drawback is that less light is generated than by the spark, thus requiring the use of a special image amplifier tube in such a chamber, amplifying the light intensity about hundredfold. Such a detector is called a streamer chamber.

The world's largest, 5-meter long, streamer chamber has been constructed recently at Dubna. One of the most important characteristics of the completed streamer chamber is that the streamers are so small that the number of streamers formed within 1 cm--i.e., the specific ionization--can be determined, making it possible to identify the particles passing through the chamber. The RISC chamber is placed in a magnetic field in order to determine the pulse; the events occurring in it are photographed. The RISC is a hybrid detector, in which the streamer chamber is surrounded by several counting (scintillation, proportional, Cherenkov) detectors.

Because of the importance of the subject, we report about this instrument and the hadron investigations carried out with it in a special article.[6]

In the measurements already mentioned, we used a so-called visual detection technique; i.e., the events were recorded optically. This fact also determined the form of a collaboration. The photographs obtained during the experiment, recording several hundred thousand events, are distributed among the participating member states; each processes the portion assigned to it in its own domestic laboratory. The processing involves several activities: determination of the track of the particles (geometric reconstruction), determination of the pulse and direction of the thus-formed particles, and finally physical evaluation. The work of the participating laboratories is reconciled at regularly scheduled work sessions.

The visual detectors play an important role in particle physics; however, another type of detector family, the so-called counting detectors, has also been developed. In their case, the events are recorded in the form of an electric pulse on a magnetic tape. Below, I describe three studies of this type.

3. The K^{o} Regeneration Measurement

At the beginning of the 1970's, it was generally accepted that as the energy increases, the total cross sections keep decreasing, tending toward a constant limit value. According to another generally held opinion, the difference of the total cross section of the particle and the antiparticle tends asymptotically toward zero with increasing energy (Pomeranchuk theorem). At that time, both viewpoints were supported by experimental facts.

The first dissonance in the harmony of the observations appeared during the discovery of the phenomenon called the Serpukhov effect: the total cross sections in the various reactions kept increasing with increasing energy. At the same time, in contradiction to preveious expectations, we did not observe an approach of the particle antiparticle cross section differences in the 20-50 GeV energy range. The problem may be approached experimentally in two ways. One method consists, of course,of the precise, separate determination of the $K^{+}p$ and $K^{-}p$ total cross sections within the whole energy range followed by the determination of the differences and study of energy dependence of this difference.

Another, more effective method involves the study of the regeneration of neutral kaons. The regeneration phenomenon itself is as follows. Originally, we had a pure K^{o} beam at our disposal; if it is applied onto any material, then an anti-K^{o} appears in the pure K^{o} beam. As a result, we obtain the difference of the forward scattering of K^{o} and anti-K^{o}. The method presents two important advantages over the previous one. On the one hand, the direct result of the measurement is the amplitude difference; the systematic errors appearing in the determination of the absolute cross section do not take place. On the other hand, in addition to the virtual portion of the amplitude difference, its real portion may be also determined, making it possible to carry out an independent check of the Pomeranchuk theorem.

We studied the regeneration of neutral kaons on the beam of the Serpukhov accelerator with the help of a magnetic spectrometer built by the Dubna institute. We carried out our measurements in the 15-50 GeV energy range, using a 3-meter-long liquid-hydrogen regenerator. In the installation, we used spark chambers as coordinate detectors; during the preparatory period, we replaced them with higher time resolution proportional chambers, which allow handling a larger number of particles. The proportional chambers were developed and built at the Central Research Institute of Physics. The

measurements proved that the energy dependence of the kaon-antikaon forward scattering amplitude difference is not in contradiction with the Pomeranchuk theorem.

Beyond the scientific significance of the experiment, I would like to emphasize the administrative or methodological novelty by which the K^0 regeneration experiment opened up a new chapter in Hungarian particle physics investigations. On the one hand, this was the first Hungarian counting experiment; on the other hand, in the Dubna relation we "invented" the collaboration based on magnetic tape instead of the previous one based on film. These experiments illustrate quite well how a small laboratory can offer a contribution of commensurable value of that of leading institutions.

While Serpukhov and Dubna institutes were busy with the construction of the accelerator and of the experimental installation, serious problems arose in the field of software and computer capacity. Beyond their participation in the measurements, the Hungarian physicists played a long-needed role in the development of a completely original program package. The collaboration between the Hungarian Academy of Sciences and the Joint Institute for Nuclear Research is illustrated by the fact that the Hungarian Academy of Sciences provided several hundred hours of machine time out-of-turn on the CDC-3300 computer which just started its operation and was not excessively busy.

4. Deeply Inelastic Muon Scattering

It is well known that, during the 1920's, Rutherford scattered alpha particles on thin metal foils; as a result of this experiment, he succeeded in proving the existence of atomic nuclei. This classical experiment revealed the exact structure of the atom and created the foundation of nuclear physics.

During the second half of the 1960's the SLAC laboratory (United States) carried out experiments similar in principle and in philosophy, using high-energy (several GeV) electrons. The electron scattering revealed a deeper level: the proton is not pointlike but possesses a structure, as if there were small "nuclei," designated as partons in the protons (later it was found that the partons are identical with quarks).

The latest variant of this experiment is being carried out by means of the deeply elastic scattering of muons. The term "deeply elastic" implies that we penetrade very deeply into the structure of the object being examined and study high-pulse transfer processes. The replacement of electrons by muons is significant because the muons may be accelerated to considerably higher energy, while in electrons at very high energies, very high bremstrahlung losses appear. Thus, this modern Rutherford experiment is used to investigate the structure of hadrons. With the help of protons accelerated to 400 GeV by the super-proton-synchrotron of CERN the highest energy muon beam in the world--and at a given energy level, the highest intensity beam--may be created.

The fineness of the resolution of the structure depends on the square of the average transmitted pulse. The experiment in question is able to penetrate in the 300 $(GeV/c)^2$ range, representing a world record. This experimental installation is a typical example of "big science": CERN-Dubna-Saclay-Munich-Bologna contributed about 20 million Swiss francs or corresponding instrumentation and 40 to 50 persons for 8 to 10 years.

The target consisted of a 50-meter-long graphite rod, liquid hydrogen or liquid deuterium. The detector consisted of a 2.7-meter diameter, 50-meter long iron cylinder, weighing 1,600 tons which surrounded the target. In the toroidal magnetic field, the wave-shaped tracks of the muons scattered on the nucleons forming the nuclei of the target are detected with the help of liquid-scintillator triggered counters and proportional chambers. All of the toroidal magnet and about half of the 160 proportional chambers were developed and built at Dubna.

Experiments have been carried out with the help of this installation since 1979. The main problem is the processing of the approximately 10 million events. Even at CERN there are not enough people and capacity for processing such a large volume of data. We just prepared the first final publication based on material from 1979. Thus, the Dubna institute is one of the chief participating partners in this experiment. Several of the Hungarian experimental physicists working at Dubna participated in this measurement, in part at Dubna and in part after several years at CERN. This participation involves cooperation in the experimental process and also the computerized processing of part of the experimental material, either at CERN or at Dubna. Moreover, thanks to the IBM computer of the Hungarian Academy of Sciences, Budapest is able to participate directly in the evaluation effort.

5. The Neutrino Detector

The chief attraction of experiments carried out with neutrinos is that the neutrino is the sole particle participating only in weak interactions. At the same time, the basic problem of experiments carried out with the neutrino is due to the extremely low level of the interaction cross section of the neutrino: its order of magnitude is 10^{-44} cm^2. In view of this, extremely large installations are needed to detect the neutrino. Throughout the world great efforts are made to build increasingly higher efficiency neutrino detectors. During recent years, consideration was given at Dubna and Serpukhov to building a modern, high-capacity, universal modular neutrino detector by the joint effort of the two institutes in order to accelerate the development of neutrino physics. The 50-meter detector weighing 1,000 tons will consist of the following five parts:

a) Scintillation hadron calorimeter (150 m^3), whose task is to measure the energy released in the neutrino interaction and to detect the products of the interaction formed in it.

b) The interactions may be divided into two large groups: one refers to the interaction mediated by so-called neutral currents, and the other, by charged currents. In the first case, no muons are formed; in the second one, a muon is always created. In order to be able to differentiate the two event types unequivocally in the experiment, care must be taken to detect the muons with a high efficiency. In order to ensure this, the scintillation calorimeter is surrounded at every side by a magnetic shell in the form of a rectangular band. This sends back into the detector the muons that are about to leave it.

c) Similarly, for the purpose of detecting the muons, a magnetic muon spectrometer is placed at the end of the calorimeter; its task is to detect the muons generated in the interaction and to measure their pulses. The muon spectrometer consists of 18 4-meter-diameter magnetized iron disks.

d) In order to determine exactly the track of the secondary particles formed during the interaction, coordinate detectors (drift chambers) must be placed between the scintillation detectors of the calorimeter, the individual elements of the magnetic shell and the muon spectrometer; this will enable us to follow the track of the particles. Altogether, there are 120 drift chambers, representing in toto about 16,000 wires. This is a 16,000 wire electronic unit which indicates the complexity of the experimental task, the necessity for miniaturization and the scale of the expenditures.

e) A large block of nuclear emulsion is placed in front of the overall detector in order to take advantage of the benefits provided by the emulsion detector, should the interaction occur within the emulsion. The area surrounding the interaction can be very exactly observed in the emulsion. However, the subsequent fate of the generated secondary particles cannot be traced because they soon leave the emulsion. On the other hand, they can be easily detected later with the help of several coordinate detectors placed behind the block. From the tracks observed there, we are able to conclude at which portion of the emulsion block the intraction took place. This greatly simplifies the processing of the emulsion, where the main problem consists in subjecting the exceedingly large-volume emulsion-- 100 x 30 x 5 cm^3 --to a microscopic study in order to find a few rare neutrino interactions. However, now we possess an "aiming device," which indicates the immediate neighborhood of the interactions with a precision of about 100-micrometers.

Operation of the detector will be initiated at the existing Serpuhkov accelerator, at the maximum energy (76 GeV) of which, about "only" 5-10 GeV neutrinos are expected. Although this does not represent a world record as far as energies are concerned, this range presents advantages. First of all, this energy range represents a no man's land; it was jumped over during development: throughout the world previously much lower, and at present much higher, energy ranges are being investigated. Second, in this spectrum range we are able to reach such a high neutrino intensity only jointly with all the neutrino beams of the world's accelerators.

Disregarding the preceding, the expected application of the detector will depend on the giant accelerator, the 3,000-GeV UNK, now under construction, to be completed by 1990 at Serpukhov. (A modest staff of Hungarian technicians has been participating during the past few years in the planning and construction of some of the control elements of the accelerator).

The Serpukhov institute plans to create a special electro-neutrino-enriched beam. In the normal neutrino beams mostly muon neutrino is found and electron neutrino occurs only in the order of magnitude of 1 percent. If we take advantage of the decay of the neutral kaons, this ratio may be increased to 50 percent.

A broad range of physical problems may be studied with the hlep of the detector. It is difficult to predict which of them will become timely. Based on our present knowledge, we may assume that we will be able to detect the neutrino oscillation, if this is not done somewhere else. The concept of oscillation was proposed by Pontecorvo about 20 years ago. Its principle is that if we have a pure muon-neutrino beam, then after passing through a certain distance, previously absent electron-neutrinos will also appear in the beam. This is true if the mass of the neutrinos is not exactly zero. This problem became especially interesting in recent years: according to a measurement made at Moscow, the neutrino definitely possesses a finite mass. Demonstration of the existence of the oscillation would confirm this measurement and would make it possible to determine the mass.

In any case, the neutrino detector is universal and modular, enabling us to adjust elastically to the examination of the most timely physical problems after completing the device.

Half of the instrumentation will be built at Dubna and the other half at the Serpukhov institute. Serpukhov will ensure the accelerating time, the neutrino beam, the neutrino channel, the scintillation detectors and one-half of the drift chambers. Dubna's task is to prepare the other half of the drift chambers, the magnets and the emulsion vertex detectors. Dubna is very experienced in this field.

Hungarian particle physicists are interested in the grandiose project, which is without any doubt the way of the future. Our participation is made possible through Dubna. Already, several of our staff members are working on the construction of the neutrino detector. This will be also one of the future tasks of the Budapest laboratory.

FOOTNOTES

1. In atomic physics the energy is measured in electron-volts (eV); this is the energy that an electron (or another particle with a unit charge) acquires when it is accelerated under the influence of a potential difference of 1 V. The larger units are 10^6eV = 1 MeV, 10^9ev = 1 GeV.

2. This sum corresponds to the present situation; 25 years ago it was somewhat smaller and reached this level by a slow gradual increase.

3. Janos Ero, FIZIKAI SZEMLE, No 6, 1981.

4. The bubble chamber is a large-volume recipient containing a liquid, in which the liquid is periodically superheated with the help of a piston. If an ionizing particle enters the chamber during this period, the liquid boils along its track; microbubbles are formed. The stream of microbubbles may be photographed (visual detector).

5. Relativistic ionization streamer chamber.

6. G. Pinter, FIZIKAI SZEMLE, No 6, 1981.

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ES 1055/ES 1055 M TWIN PROCESSOR SYSTEM DESCRIBED

Budapest SZAMITASTECHNIKA in Hungarian Apr 82 pp 1, 9

[Article by Dr. I. Sz.: "Robotron Innovations at Leipzig, the ES 1055 M"]

[Text] The ES 1055/ES 1055 M twin processor computer system channel-channel adapter (KKA-ES 4065), the new operator and service console for the ES 1055 processor, the ES 7069 M, the color picture screen system demonstrating new applications possibilities in agriculture and warehouse management, the mini-floppy Robotron K 5600.10 drive unit introduced as an OEM product, the Robotron 238 multi-microcomputer system, the most varied special purpose systems and software program packages are only selected products of the Robotron Combine and its 19 plants, employing 70,000 workers, which astonish visitors to the fair year after year.

In this article we will talk in more detail about the twin processor system and about the mini-floppy drive unit.

The factory is offering the ES 1055/ES 1055 M twin processor system for the following applications areas:

--for nuclear physics, space research, seismological and energetics research and development, with special regard to the utility of the matrix module (MAMO),
--for control and automation of complex, extensive processes, primarily in industry and transportation,
--for reservation and information systems, primarily in the area of transportation, tourism and the hotel industry,
--for automation of commercial processes and maritime and port management,
--for calculating up-to-date results for financial, insurance and meteorological services, and
--for development of complex and comprehensive guidance and information systems, primarily to carry out the tasks of central state and other economic guidance institutions.

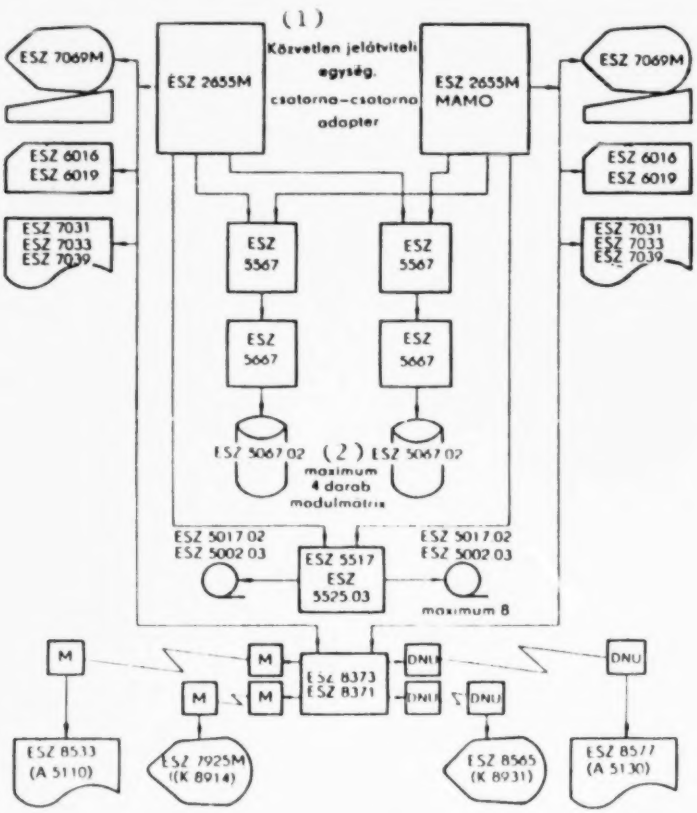
The innovation of the twin computer system was the KKA-ES 4065 channel-channel adapter, the direct signal transmission unit and the two-channel control unit.

The KKA (CCA, channel-channel adapter) helps the user to move large volumes of data while the direct signal transmission unit one can exchange smaller volumes of data between the two computers.

With the two-channel control unit of the external stores the data to be found in the stores can be used by both computers. The system uses a version of the OS/ES operating system adapted to the configuration, which contains a multi-computer support program component. Another important component of the operating system is the asymmetrical multi-computer control system. (The configuration can be seen in the diagram.)

The storage capacity of the data carrier of the Robotron K 5600.10 mini-floppy drive unit, working with a 5 1/4 inch floppy disk, is 125 or 250 K bytes depending on the writing mode (FM or MFM).

Storage capacity is 1 M bits (FM) or 2 M bits (MFM); the writing method is FM or MFM; transmission speed is 125 K bytes per second or 250 K bytes per second; the maximum number of bands is 40; band density is 48 bpi; cycle time is 300 /min. plus or minus 2 percent; rest time is 25 ms; head set time is 40 ms; run-up time is a maximum of 1 second; power supply is plus 12 volts plus or minus 1.2 volts and plus 15 volts plus or minus 0.25 volts; power requirement is a maximum of 20 watts; weight is 1.5 kilograms; and the size is 60 x 200 x 141 millimeters.



(Consists entirely of equipment model numbers except for the following)

Key: 1. Direct signal transmission unit, channel-channel adapter
2. Maximum 4 darab modulmatrix--maximum 4 unit module matrix

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ADAPTION OF IDOS FOR THE VT 60

Budapest SZAMITASTECHNIKA in Hungarian Apr 82 p 11

[Article by Miklos Szabo: "Adaption of the IDOS Operating System for the VT 60"]

[Text] Several years ago, the SZTAKI [Computer Technology and Automation Research Institute], the IDOS (interactive disk operating system) was prepared for the ESZ 1010 computer. The system makes possible a high level conversational operational mode, fast and easy text editing, translation and easy to review documentation.

The IDOS system is known and recognized even beyond our borders; the number of users, who use it every day as a working tool, can be put at several hundred. Its use is easily mastered and it is simple to handle. The reliability of the system--even in the face of hardware and operator errors--is very good.

The IDOS merits attention not only as an independent operating system but also as a developmental tool and special purpose tool. We used IDOS in the development of two big projects, using the system developed for the ESZ 1010 but not the IDOS monitor (in the first case for the RTDM and in the second for a special purpose monitor). According to our estimates use of the IDOS can result in time savings of 40-50 percent, in the given case this means man years.

The VT 60 is the smallest member of the new computer family of Videton (the VT 60, VT 600 and VT 6000), which is the model replacing the ESZ 1010. The architecture and hardware construction of the VT 60 differ radically from those of the ESZ 1010. The VT 60 CPU is somewhat faster than that of the ESZ 1010; its peripherals are activated by intelligent--microprocessor--connections (controllers). These can be managed with a channel program and data transfer is realized with direct memory access (DMA).

The VT 60 has an expanded instruction set, as compared to the ESZ 1010, and has new addressing modes; its memory can be expanded to 128 K bytes. Some of the instructions existing in both machines (for example, string operations) can be used in the VT 60 only with certain restrictions; thus the compatibility of the two machines at the user program level is not complete.

IDOS/60

The IDOS/60 system was born in the SZTAKI as a by-product of network building work. Our goal in developing it was to provide a tool for development of network software on the VT 60 computer. Previously there was no system which efficiently supported developmental work, so we adapted the IDOS operating system to the VT 60. In the course of past years many types of programs were prepared which run under the IDOS system of the ESZ 1010 (cross assemblers, simulators, compilers). Manufacture of the ESZ 1010 has ended; with the adaption of the IDOS these programs will work on the VT 60 also.

We adapted the IDOS with the so-called bootstrap method. First we prepared a reloading program suitable for reloading data files archived under ESZ 1010 IDOS from the ESZ 1010 computer to the VT 60 disk on the serial data transfer line, with the aid of the DTM data transfer system developed at the SZTAKI.

The second step was to prepare an IDOS monitor of minimal size which would run on the VT 60 but was capable of handling only the disk and display. We generated the text editing, translation and monitor object code on the ESZ 1010; alignment took place with the aid of the microprogrammed console of the machine after reloading into the VT 60.

As a third step in the adaption--now working on the VT 60 computer, exploiting the services of the above, so-called MiniIDOS--we wrote and aligned the program handling the other peripherals.

Finally, we prepared the modification of the standard programs and the system documentation.

Peripheral Handling, New Services

At present the system handles the following peripherals:

--a VDT52106 picture screen console, on the serial asynchronous line,
--a VDT52120 operator's picture screen, on the serial asynchronous line,
--an IZOT 1370 disk,
--a MOM floppy disk,
--line printer,
--card reader, and
--a real time clock.

In the course of the development we also created other services:

--automatic restart in the event of disk change and power return,
--emulation of floating point instructions, and
--diagnostics.

In the course of the adaption we rewrote the machine dependent parts of the IDOS monitor (the hardlers) and made minor modifications in the archive and service modules.

In the course of VT 60 implementation of the IDOS it turned out that the biggest problem was not in programming technique but in system technique. Namely, were the presently available (Videoton) displays and connections suitable for use in a system of the IDOS type? The IDOS depends fundamentally on a fast alphanumeric display; the convenience and utility depend on the speed of this. This was available on the ESZ 1010, but the displays can be connected to the VT 60 only via the serial line. The maximal line speed of these is suitable (9,600 baud) but on the equipment available to us (for example, the VDT52120) this could be done only to characters visible to the eye. The execution time of the control characters (cursor movement, screen erase, new line) is slower by an order of magnitude than the speed of the line, so there could be character loss.

Since the VDT terminal family is intelligent (it buffers characters arriving from the line) the usual method in serial data transfer, sending so-called PAD characters, does not help the situation. The compromise solution is appropriate selection of the size of the line buffer (FIFO); which, unfortunately, is small for the equipment mentioned above.

In theory there are three ways to solve this problem:

--modify the microprogram of the terminal,
--radically reduce the line speed, or
--delay completion of the operation with software timing when transmitting the control character.

The first would mean a modification which only the manufacturer could carry out; the second would make the system unuseable; we solved the problem by using the third method.

Further difficulty is caused if the character set of the display and the keyboard is not compatible with that of the VT340 used with the ESZ 1010 (i.e., with the "insert line," "delete line," etc. functions of the 16 line display). In this case also the system programs must be modified. The VDT52120 used fulfills this compatibility but the picture screen console delivered for the VT 60 machines does not.

The floppy disk became the saving peripheral for the VT 60 system, since we did not have a magnetic tape unit. The format used is identical with the IBM 3741 disk format.

Although in the course of adaption we made a maximum effort to maintain compatibility with the ESZ 1010 IDOS we could not do so perfectly for hardware reasons (the deviations, however, are not significant). In regard to its "services" the IDOS/60 corresponds to its ESZ 1010 predecessor. The only innovation --which does not affect the user directly--is that we built a diagnostic module into the system. This administers the number of transfers and errors on the several controls and distributes the load between the CPU and the several connections. We obtained interesting experience with use of the diagnostic module which proved the reliability of the IDOS/60 and which will be useful for optimizing the system (and several standard programs).

The programs and documentation prepared or modified by us in the course of the adaption are:

--VT 60 disk bootstrap loader,
--VT 60 IDOS monitor,
--SYSGEN system generator (floppy disk became the saving peripheral),
--DATAEDITOR program providing system maintenance functions (the management strategy of the display was modified),
--SAVELOAD (saving reload between disk units or onto floppy disk),
--STARTER (an independently running program starter),
--VT 60 IDOS MA' JAL, and
--VT 60 SYSMANUAL (containing a description of the hardware-software interface of the VT 60 computer and information about the machine acquired empirically).

According to comparative measurements done with different programs on the ESZ 1010 and VT 60 machiens the ESZ 1010 IDOS system is 10-40 percent faster than the IDOS/60. This is explained by the fact that we use a fixed head disk (MOM) on the ESZ 1010 and a moving head disk unit on the VT 60.

Ideas for Further Development

If Videoton solves the problems mentioned earlier in connection with the operator's display (VDT52120) then there will be no obstacle to preparation of VT 60 TS IDOS (time sharing IDOS). An ESZ 1011 version of the VT 60 IDOS--as an independent system--could be prepared from the IDOS/60 with a few weeks work. Realization of an ESZ 1011 TS IDOS might create an optimal developmental environment for developmental tasks aimed at development of special purpose microcomputer systems, where the hardware characteristics of the machine (1 M byte memory, 20-100 M byte disk) have promising prospects. Nor should we neglect the possibility that only the monitor may have to be written for this, running the existing programs without change under the IDOS systems.

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TPA 1148 DOMESTIC MEGAMINI

Budapest SZAMITASTECHNIKA in Hungarian Apr 82 p 5

[Article by Ferenc Bati, Pal Endrody and Gyorgy Matakovics of the KFKI (Central Pysics Research Institute): "TPA 1148, Domestic Megamini"]

[Text] In the last 4-5 years the TPA 11 minicomputer has been used in virtually every area of the economy. The first configurations, with 32 K words of ferrite ring operational memory and a 5 M byte disk, were followed by systems with 128 K words of semiconductor operational memory and 20-40 M bytes of disk background storage. The number of operating systems already exceeds 100 and according to projections will increase more than three times within 3 years. Systematic analysis of user experiences and a determination of further development goals on the basis of experience are indispensable in growth of such magnitude.

A survey done at the beginning of 1981 pointed to the following applications bottlenecks and newly appearing needs.

In a multiprogramming, multiple user, software development environment 5-6 tasks running in parallel exploit to the maximum the available storage. Adding another work site results in a significant increase in "check pointing" and thus a slowing of response times.

For larger programs (especially for CAD tasks) the 32 K words of virtual memory is a restriction the solution of which with the aid of the overlay technique cannot be done with a good degree of efficiency.

The maximal disk capacity of 20-40 M bytes slowly proved to be too little; the data bases developing in some applications increasingly make necessary the use of disk units with a capacity of 80-100 M bytes.

At more and more institutions they are thinking of creating a network consisting of distributed resources, which will require inclusion in the system of new communication hardware and software modules.

The lack of a floating point processor, decimal arithmetic, string handling instructions, etc. causes problems for an increasing number of users.

On the basis of these things our developmental goals are the following.

The minicomputer development followed thus far must be replaced by development of a megamini computer. There is a need for megamini systems which, being compatible with the TPA 11 machines already in operation, will make it possible to use the user programs without any change while at the same time (by increasing their performance) putting in the foreground a solution of the problems listed above. The first result of this new strategy is the TPA 1148 which, thanks to intensive development solutions, will go into production this year at the Experimental Plant of the KFKI MSZKI and at the Deposit Association of the Experimental Computer Technology Plant in Szekesfehervar.

The most important extra services of the TPA 1148, as compared to the TPA 1140, are:

--Storage capacity can be increased from 256 K bytes to 4 M bytes, since the number of store-resident programs can be substantially greater without slowing the response time. With 1 M byte of operational memory one can run 15-20 tasks in parallel.

--In addition to the Kernel and User mode there will be a third, the Supervisor operational mode, and instructions and data can be put into operational memory separately (I space and D space).

These two hardware expansions make possible an increase in the upper limit of virtual memory (2-3 times), thus one can run 60-80 K word programs without the overlay technique.

--The number of general registers increases from 8 to 16; use of an 8 K byte cache memory (optional) results in further acceleration of program runs.

--A microprocessor background store control family serves to control large capacity magnetic disk and magnetic tape units. The devices adapted are: 80 M byte exchangeable disk packs and fixed disk (SMD connecting surface) magnetic disk units; and 800/1600 bpi recording density magnetic tape units with speeds of 45, 75 and 125 IPS.

--Fixed head disk emulation based on large capacity semiconductor storage elements provides a very fast background storage possibility.

--A multiprotocol, synchronous line interface provides direct hardware connection to the postal data network and hardware support for managing various data transmission protocols; development of a high speed (1 M bit/s) synchronous line interface for building local nets is under way.

--A microprocessor, intelligent operator's console providing remote diagnostic possibilities and carrying out certain "debug" functions helps in the development of a high level man-machine link.

A very essential developmental viewpoint was a study of the possibility of expanding the TPA-1140 systems already installed. Relying on the solutions used in the TPA 1140, the electrical and mechanical design of the TPA 1148 was

developed in such a way that an 1140-1148 conversion is entirely possible. Thus, those users who have "outgrown" their TPA 1140 systems will not be forced to buy an entirely new system; rather, keeping their present equipment, they can convert the central units and expand memory and the peripheral system to the extent needed.

In the course of development we strove for solutions which would make the expansion well founded from the economic side also. This means, for the users, that an expansion from 256 K bytes to 1 M byte will cost about as much as the 256 K byte store cost earlier.

As we mentioned already, the TPA 1148 is compatible from above with the earlier TPA 11 machines; the operating systems and user programs running on the TPA 1140 can be run on the TPA 1148 without any change. In addition, we will introduce an operating system exploiting the new hardware services of the TPA 1148 as well as data base management, transaction processing and network program systems.

We will return another time to a description of the new software tools.

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ASSETS, DEBITS OF THE SZM-4

Budapest SZAMITASTECHNIKA in Hungarian Apr 82 p 3

[Article by Adam Kis: "The SZM-4; What There Is And What Is Missing"]

[Text] By the end of the second year of sales in Hungary of the SZM-4 minicomputer (1981) about 30 units had found owners in our homeland. SZAMITASTECHNIKA has dealt a number of times with this computer model in the recent past. In essence the articles which have appeared contain everything which one can know about it in theory. The article by Lajos Ivanyos (July-August 1981) described, on the basis of practical experiences, the place of the SZM-4 in applications. Still, on the basis of comments at professional meetings and questions from those interested, we must conclude that there are certain misconceptions in connection with the SZM-4 computer due to a lack of information. I do not want to repeat the technical description, because there have been no changes in the principles of the systems. Nor do I want to deal with quality-reliability questions. My goal is simply to report on the possibilities available in 1982, reviewing also those devices and solutions which should be available but which, for the time being, we cannot provide.

How Many Types of SZM-4 Are There?

The SZM-4 model designation does not identify a single definite product, but rather an entire family of products. A computer of similar category and design is made in practically every socialist country. The name of the Bulgarian, Czechoslovak and Soviet product is SZM-4; but the Robotron A 6402 made in the GDR and the Romanian I-100 are compatible with the other members of the family. The SZAMALK [Computer Technology Applications Enterprise] currently sells the Czechoslovak and Soviet systems, but steps have been taken to import systems of Bulgarian manufacture also.

Up to now we have had no way to compare the various SZM-4's. At the moment only machines from the Soviet relationship are in operation; more precisely, the first models from Czechoslovakia are now being put into operation, and there is not yet an agreement on importing the Bulgarian machines.

What justifies parallel trading in the three versions? First of all we must note that these machines are uniform in principle; they were developed after the same prototype, their peripherals are largely identical, the software is essentially the same. But in the course of trading we are expecting something

different from each relationship. The Soviet product is the basic one and will make up the great majority of the imports. The SZAMALK has taken over from the manufacturer the technical servicing of this machine, so it will be possible to change the configurations arriving, adjusting them to the individual needs of the user. We are offering the Czechoslovak product because of its special extra services and more modern technology. In introducing the Bulgarian version our purpose will be primarily to take over from the manufacturer finished applications systems, the so-called special purpose systems (POK) [possibly, Postal Training Center], handing these on to Hungarian users. In the first phase we want to examine the possibility of domestic use of the systems called INFOREG or SZAIT. (These two special purpose systems were described briefly in the September 1981 issue of SZAMITASTECHNIKA.)

What Is The Situation in the Area of Hardware?

The December 1981 issue of the journal describes the composition of the Soviet SZM-4 configurations which can be purchased in 1982. The appearance of the 29 M byte magnetic disk stores and the 16 channel asynchronous multiplexer represents a significant step forward. But it is no less important that beginning this year the Soviet partner will deliver a number of smaller supplementary devices extraordinarily important for efficient operation of the system, such as the bus amplifier and the two line asynchronous adapter which can be built with loop output. (With the aid of the latter the terminals can be placed at a maximum distance of 500 meters from the central machine.) Hardware devices providing machine-machine links (MSZR-MSZR and ESZR-MSZR) are slowly evolving from technical possibilities to commercial realities. Unfortunately, this is not yet true of the software needed for this.

One outstanding innovation of the Soviet system is the semiconductor store, the appearance of which not only increases the reliability of the system but also results in a significant reduction in price; the price ratio of the ferrite and semiconductor stores (with the same capacity) is nearly four to one; that is, one can buy four semiconductor stores at the price of a single ferrite store. The only problem with the semiconductor solution is that it consists of 64 K word modules, so it is not possible to develop small capacity configurations.

We should also mention a few devices in the Soviet offering for which we cannot expect great demand but the appearance of which influences the total picture. One such is the graphic display, which is outstanding for its very low price. There may be interest in a unit called an interface segmentator also, which serves to reduce the burden on the bus, especially when using peripheral equipment which has a large need for operational memory.

Hardware innovations of the Czechoslovak system include the magnetic tape (although this is an innovation only here) and the eight channel asynchronous multiplexer.

In regard to the composition of the Bulgarian systems we know that they are equipped with 29 M byte magnetic disk background stores. But we will be able to provide positive information about this system only when the Bulgarian side makes a foreign trade bid.

It is a common characteristic of the two types of SZM-4 available that in order to avoid superfluous foreign trade activity the shippers leave to the Hungarian trading side the solution of the display problem. In 1982, thanks to an agreement with Videoton, we will be able to deliver to users a suitable number of VDT 52102 picture screen displays. Connecting the picture screen displays presents no problem at present. It must be noted that the above does not apply to the consoles, in both cases the shipper provides these; a VDT 52120 is used in the Soviet systems and the Czechoslovak systems have a picture screen display terminal manufactured by Tesla. In addition to the above it is theoretically possible to include an Orion ADP-2052 display in the system.

The Videoton line printers are essential domestic products; thanks to these it is possible to put together configurations with greater writing speed. These line printers have Hungarian character sets--this is indispensable in certain applications.

Background storage continues to be the critical part of the hardware supply. A significant improvement in this area can be expected in 1983, when delivery of the 29 M byte magnetic disk subsystems may become general. Development of 100 M byte subsystems is progressing reassuringly in Czechoslovakia. In addition to all this it would be advantageous to supplement the background storage offerings with the highly reliable Winchester disks and other modern solutions.

Very great tasks face the developers in the area of minicomputer networks and remote processing also.

SZM-4 Software at the Beginning of 1982

In 1979-1980, when the SZM-4 appeared on the market, it was a great difficulty for users that the basic software delivered at that time did not make possible exploitation of the functional possibilities in the hardware.

This basic software was suitable primarily for technical-scientific calculations, technological process control and laboratory control purposes while the justification for general domestic use of this model was to satisfy data processing and economic application needs.

Results achieved in 1981 far-reachingly justified the preconception for the development of this model. With the aid of the experience available the problems connected with the basic software could be solved quickly. From the end of 1980 the Soviet shipper provided the OSZ RV operating system. Although this operating system cannot be called "data processing software" either, still it was a significant step toward satisfying the needs of users. All the more so because the software team of the OSZV [National Computer Technology Enterprise] (the SZAMALK is its legal successor) developed relatively quickly on the basis of this, as an expanded version of the OSZ RV, the OSZ RV/E, which can be well used for data processing purposes also. This system is being supplemented with elements (data base management, ordering, data querying tools) the existence of which is indispensable in economic applications. Basic software was also prepared for users needing smaller capacity; this is very developed software and can be compared favorably with other well known basic software.

In the area of applications software the great event of the year before us will be the adopting of the SERIES-IV data collection software and the import of the DIAMSZ (MUMPS) data management system from Czechoslovakia, the Soviet Union or Bulgaria.

How to Proceed?

Applications possibilities for the SZM-4 minicomputers require posting such tasks as realization of homogeneous minicomputer nets, the development of SZM-4 based terminals, the development of terminals which can be connected to the SZM-4, the development of highly reliable dual systems, etc. I feel confident in saying that the nucleus for the solution of these tasks exists. One pledge of their realization is MSZR [minicomputer system] cooperation, but we can also hope for much from domestic users, who are showing more and more interest in the SZM-4.

Despite the initial problems appearing in the first years of using the SZM-4 the effective utility of the systems can be established. Thanks to bringing into harmony the functional possibilities and capabilities of the machine and the needs of domestic users it has been possible to create a real market mechanism which can have a crucial effect on both manufacturing and trading policy, forming and standardizing demand for small category computers. So we can hope that a real demand for minicomputers will develop.

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SOFTWARE FRAME SYSTEMS FOR ESZR MACHINES

Budapest SZAMITASTECHNIKA in Hungarian Apr 82 pp 1, 10

[Article by Margit Takacs: "Software Frame Systems for ESZR Machines"]

[Text] Improving the supply of software is a task of great significance and fundamental importance in increasing the effectiveness of the capacity needed to achieve computer technology application goals. In the interest of providing uniform, good quality programs for domestic and socialist import devices modularly constructed frame systems are being compiled based on the software systems delivered with the machines and, where necessary, on elements deriving from capitalist sources and supplemented with domestic developments. On commission from the Computer Technology Applications Main Department of the KSH [Central Statistics Office] the Computer Technology Applications Enterprise (SZAMALK) is developing these within the material framework of the Computer Technology Applications Development Fund.

Our article will give an overview of the frame systems prepared thus far, developed by the Developmental Directorate of the SZAMALK.

Our computer centers operating ESZR [Uniform Computer Technology System] computers--using both ESZR and IBM operating systems--often struggle with compatibility problems between the operating system and the supplementary program products or between the operating system and the hardware. These problems have been solved more or less or they got around them, in almost as many ways as there are computer centers, with wasted effort, individual initiatives and frequent parallelism. Systems modified and supplemented in this way become incompatible and the transfer of program products becomes clumsy. In addition to solving their actual applications tasks, or instead of doing so, the users have had to deal with the development of basic software also.

The Computer Applications Research Institute (SZAMALK is its legal successor), in cooperation with the Computer Technology Coordination Institute, developed a number of frame systems to facilitate the installation, generation, testing and operation of the operating systems used on ESZR machines. By using these one can produce harmony between the hardware, the operating system and the various program products, and this also means that user programs and systems can move more easily between computer centers using the same frame systems. These frame systems ensure the technologization of the process extending from the reloading of the system to the initiation of operation. In addition to methodological descriptions, these also provide procedures and jobs which can be simply and flexibly changed and run in accordance with local needs--with a JCL text editing program. Thus a new system can be generated easily with a sequence of operator activities done according to a scenario.

The frame system is a uniformly compatible collection, based on one basic operating system, consisting of a "starter" which makes generation possible, a pregenerated system, component libraries, a spooling system (programs improving the efficiency of the operating system primarily in handling slow peripherals), various auxiliary tools (procedures and programs aiding installation, generation, testing and operation), separate program products and a system for the conversational mode.

Documentation needed to use the frame systems has been prepared and it contains the functional possibilities of the frame system elements, basic use information, machine devices and procedures.

There is a possibility in the frame systems for use of the program products which can be leased from IBM: PLIOPT, SORT/MERGE, COBOL, etc. (These are not parts of the frame system and can continue to be leased in the usual way.) It is also possible to use other products traded by the SZAMALK (such as SLICK).

The frame system based on IBM DOS/VS was developed in the Software Systems Technical Laboratory of the SZKI [Computer Technology Coordination Institute].

The R34-13 and R34-11 versions of the DOS/VS form the initial operating system; the latter was needed because of the deficient instruction set of some ESZ 1035 machines.

The frame system contains: a system efficiency measurement program based on IBM program products, this improves with new developments the optimal satisfaction of the hardware and software resource needs of the operating system and the applications systems; procedures which facilitate operation and use of the system by operator and user and ensure protection of the system; and a uniform accounting system developed by the SZKI which counts and totals up machine time used in the batch and conversational mode.

The system was prepared in November 1981 for the ESZ 1055, ESZ 1035 and ESZ 1015 computers. An applications description in the Hungarian language is available to the user to aid use of the frame system. Switching to use of the frame system, and this is true of the other frame systems also, goes very easily in general; at a new computer center just getting started it requires only a few hours of machine time and the system can be operated on a regular basis in the first week. If DOS was used earlier on the computer then the brevity of the switchover time depends on the "specialness" of treating the data files on disk. In regard to transfer of applications programs one should consider what changes should be made--simply because the frame system offers new possibilities.

The frame system based on IBM OS/360 21.8F was developed in the Systems Development Main Department of the Computer Applications Research Institute (SZAMALK is its legal successor). Two versions were prepared. One is an MFT pregenerated system for the ESZ 1022 and ESZ 1040 computers, with HASP II. 3.1 spooling and a CRJE conversational mode system. The other is an MVT pregenerated system for the ESZ 1035 and ESZ 1055 computers, with HASP II. 3.1 spooling and a TSO conversational mode system. A number of modifications were made to the basic IBM

OS/360 21.8F operating system: for example, it is possible to use the IEBCOPY auxiliary program with magnetic tape files and not only magnetic disk files; error treatment by the central units of the ESZ 1022 and ESZ 1040 machines was modified; the HASP was made capable of writing out 160 character positions; etc. The following products were developed in connection with the frame system: OLTEP on-line peripheral testing programs; a collection of general purpose PL/I routines; and a program package to check operation.

(As part of the CF-52 remote data processing task the CRJE and TSO conversational mode systems adapted to the frame system were demonstrated for experts at the Csalogany Utca computer center of the SZAMALK at the beginning of March).

The frame system based on the IBM DOS/360 26.3 and POWER II. 4.1 versions was developed by workers at the SZAMKI [Computer Technology Research Institute] (later SZAMALK). The development was done on the ESZ 1022 computer of the SZAMKI and on the IBM 360/40 computer of the Danube Petroleum Industry Enterprise.

In the course of developing the frame system modifications and expansions were performed in the IBM DOS plus POWER system; by correcting design errors in the DOS the user gets a system more convenient to use and simple to operate.

The more essential developments are briefly the following. They eliminated a few job control instructions practically never used and introduced new ones in their place and they modified or corrected a few job control instructions. In order to eliminate the disadvantages deriving from the fixed priority of partitions they introduced time slicing. They modified library management and the machine error interrupt routine; collecting and writing out console messages is on the job listing.

The user can get, as a pregenerated system, a modified IBM DOS plus POWER system for the ESZ 1022. This was prepared on a 2314 magnetic disk for a computer with 256 K bytes of central storage. The pregenerated system contains POWER and a supervisor presuming 512 K bytes of central storage and suitable versions of translator and auxiliary programs are available on tape. Together with the frame they provide programs and procedures aiding installation and operation. As documentation the user receives a general guide, an installation and operation handbook and a volume describing the structure of the magnetic tapes.

Products connected with the frame system are: OLTEP on-line peripheral testing programs and a collection of general purpose PL/I routines.

When purchasing a frame system the user becomes entitled to the use of various services, on the basis of a signed contract. Upon delivery of the system the user gets, in addition to the magnetic tapes and documentation, training and the possibility of consultation. In addition to the basic services other services are provided within the framework of a special contract (for example, installation and tuning). Follow-up and maintenance of the systems is guaranteed after delivery.

They are developing a uniform error reporting, analysis, recording and correction system for the elements included in the frame systems. Errors appearing

during operation are studied, errors made in their own products are corrected, advice is given for eliminating or avoiding other errors and they constantly inform the user about errors noted by others and about the correction of them and new developments are sent automatically.

In the first half of 1982 they will prepare a frame system based on the OS/VS1 system and they are preparing to develop other frame systems also--based on the ESZ operating system.

Medium-range plans included in the CF-52 involve supplementing the frame systems with software module sets for remote processing, offering higher level services. It will thus be possible to compile, in accordance with needs of applications tasks, complex remote processing hardware-software systems consiting of standard components and elements of the frame systems.

8984
CSO: 2502/83

ANTARCTIC RESEARCH ACTIVITIES REPORTED

Geological Research

Warsaw PRZEGLAD GEOLOGICZNY in English No 2, Feb 82 pp 53-57

[Excerpt] The article reports on geological investigations carried out during the austral summer of 1979-80 on King George Island, South Shetland Islands (West Antarctica) under the guidance of the first author [Antoni K. Tokarski]. The main problems elaborated and the preliminary results of the field work are as follows:

1. The geological mapping to a scale of 1:50,000 covered an area of some 200 km^2 round King George Bay and to the west of Admiralty Bay (Fig. 1). Two other geological maps, to scales 1:10,000 and 1:35,000 were made of selected areas of the island for special purposes.

2. Tectonics of Arctowski Mountains--(King George Bay) was studied and collection of data for regional study of mesostructures in Tertiary rocks was completed.

3. New localities of Polonez Glaciation tillites (Pliocene) were found.

4. Vast area of copper porphyry mineralization in Arctowski Mountains was discovered and studied.

5. Pyrite mineralization was thoroughly studied on Keller Peninsula (Admiralty Bay).

6. Zeolite mineralization was investigated in Tertiary rocks.

7. New localities of "Jurassic" and Tertiary plant fossils and of Pliocene marine fauna were discovered.

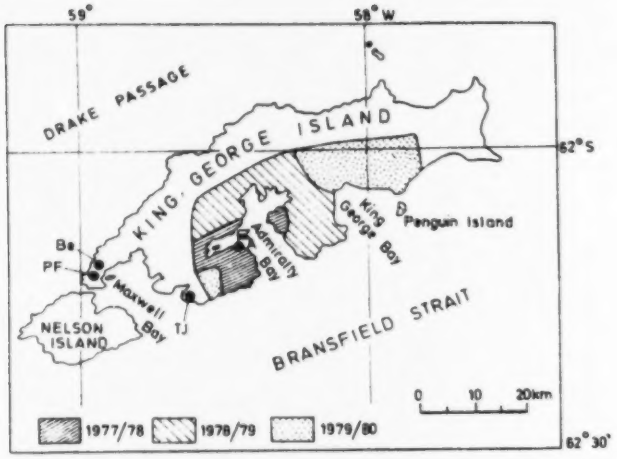

Fig. 1. Areas of King George Island geologically mapped by Polish Antarctic Expeditions.

A – Arctowski Station (Poland, marked by flag); Be – Bellingshausen Station (USSR), PF – Presidente Frei Station (Chile), TJ – Teniente Jubany Station (Argentine).

Paleontological Research

Warsaw PRZEGLAD GEOLOGICZNY in English No 2, Feb 82 pp 57-61

[Excerpt]

The paleontological studies carried out in the King George Island, South Shetland Island (Western Antarctica) during the austral summer 1980 – 1981, were primarily concentrated on highly fossiliferous marine deposits discovered in the Melville Peninsula (Fig. 1). In that area, there is exposed over 200 m sequence of calcareous-marly and, sometimes, somewhat sandy deposits. Preliminary analysis of faunal and floral assemblages showed that the deposits range in age from the Middle to Upper Cretaceous. The deposits were found to yield coccoliths, diatoms, silicoflagellates, foraminifers, corals, bryozoans, polychaetes, gastropods, bivalves, scaphopods, belemnites, ostracods, crabs, asteroids, echinoids, fisches, and they display numerous tunnels made by crabs as well as mass occurrence of coprolites. Vagile benthos clearly predominates in the studies faunal assemblage which appears typical of a shallow shelf zone with relatively quiet sedimentation.

The other important area of studies is situated in the Low Head – Lions Rump region, where marine Pliocene deposits are exposed (Figs. 1 – 2). Attention should be mainly paid to the lower, Low Head Member (= Pecten Conglomerate), belonging to the Polonez Cove Formation (K. Birkenmajer (2 – 3)). Deposits of that member are

very rich in fossils, especially coccoliths, diatoms, both benthic and planktonic foraminifers, bryozoans, polychaetes, brachiopods, gastropods, bivalves, scaphopods, ostracods, ophiuroids and echinoids. There were also found algal (? Rhodophyta) encrustations and coatings and single stromatolite structures. Attention should be paid to numerous bivalve layers. Local allochtoneous accumulations of shells of bivalves mainly representing the species *Chlamys andersson*i (Henning, 1911) may be explained by sedimentary conditions related to heavy storms. It is also worth to note the discovery of three lithological horizons with pholad burrows in the Mazurek Point area. The localities with marine fauna buried in vivo make possible paleoecological reconstructions for the Polonez Cove Formation.

Several floral localities were also revisited and exploited. A large collection of well-preserved imprints of leaves, fragments of stalks and trunks and single pollen were gathered in the Dufayel, Cytadela, Fildes Peninsula – „Mt. Flora", Potter Cove (region of Argentina Teniente Jubany Station) and Mt. Wawel localities (Fig. 1). The Mt. Wawel locality is of special importance on account of the record of the youngest (? Upper Miocene) flora in the King George Island.

In the Low Head – Lions Rump region, Melville Peninsula and Vaureal, paleoglacial deposits were sampled for boulders of sedimentary, especially carbonate rocks of Antarctic origin. Light-coloured varieties of limestones often yield crushed archaeocyathid cups and trilobite armature. The boulders appear completely exotic for the King George Island and preliminary analyses show that they were brought here either as morainic material or deposited as dropstones by icebergs coming from distant Ellsworth Mts or Transantarctic Mts.

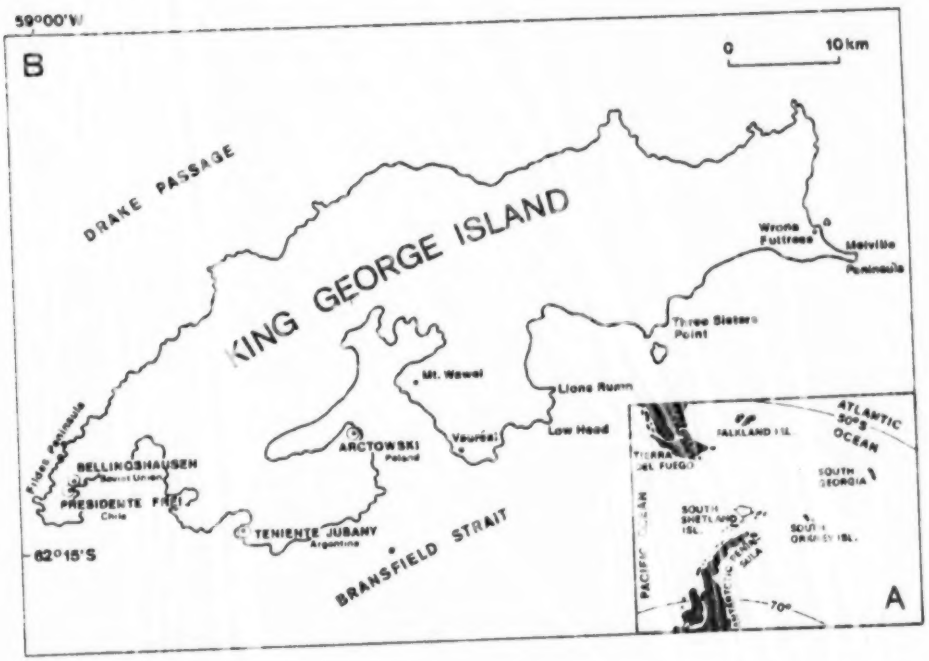

Fig. 1. Map of localities on the King George Island (B), covered by paleontological studies in the course of the VIth Antarctic Expedition of the Polish Academy of Sciences. An insert map (A) shows the location (arrow) of the King George Island in the South Shetland archipelago.

END

CSO: 2020/47

JPRS 81344

23 July 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 749

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23 July 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 749

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NEW RECEIVING TELESCOPE ADAPTERS DEVELOPED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 1, 82 pp 67-73

[Article by Senior Scientific Associate Dr Bogomil Kovachev: "New Receiving Instruments For the Telescopes of the National Astronomical Observatory (NAO) of the BAN [Bulgarian Academy of Sciences] Developed and Applied"]

[Text] In this article we shall discuss three receiving instruments: a Coude spectrograph for the 2-meter telescope, the achromatic Zeeman analyzer for the Coude spectrograph and the stellar electrophotometer for the 60-centimeter telescope.

Before giving a brief description of these apparatus and indicating their basic characteristics, let us mention that the task of developing new light receiving instruments for the observatory's telescopes remains exceptionally relevant. Whereas the optical system of the instruments, once designed, offers specific fixed opportunities for observing light sources, the receivers attached to them are the component in the corresponding registering process which depends most closely on the development of science and technical progress. With considerably more modest funds it can and must be steadily expanded and improved.

Coude Spectrograph For the 2-Meter Telescope

A number of large optical telescopes (usually with a diameter of the principal mirror of close to or more than 1.5 meters) have a fixed (Coude) focus, which is obtained when the concentrating bundle of light from the star is deflected after it has been reflected in the main and the opposite mirrors with the help of an additional deflecting mirror. In this case the light beams progress through the polar axis of the telescope and focus in a premise located under the telescope and the dome area. It is here that a larger spectrograph may be installed permanently (rather than being carried by the telescope as a spectrograph installed on a Cassegrain focus, located behind the main mirror), for photographing spectra with a broader dispersion. For instance, normally a maximal spectral dispersion of stars photographed with it in the order of up to 20 Å/mm is achieved with a universal spectrograph installed on a Cassegrain focus with the 2-meter telescope; with a Coude spectrograph installed on the same telescope it is close to 2 Å/mm, i.e., it is

greater by a factor of 10. Consequently, in this case we have the possibility of seeing, singling out and measuring separately a larger number of lines in the stellar spectrum, many of which merge (blend) with a 20 Å/mm dispersion. Naturally, this applies only to the brighter among the stars which can be observed in a Cassegrain focus.

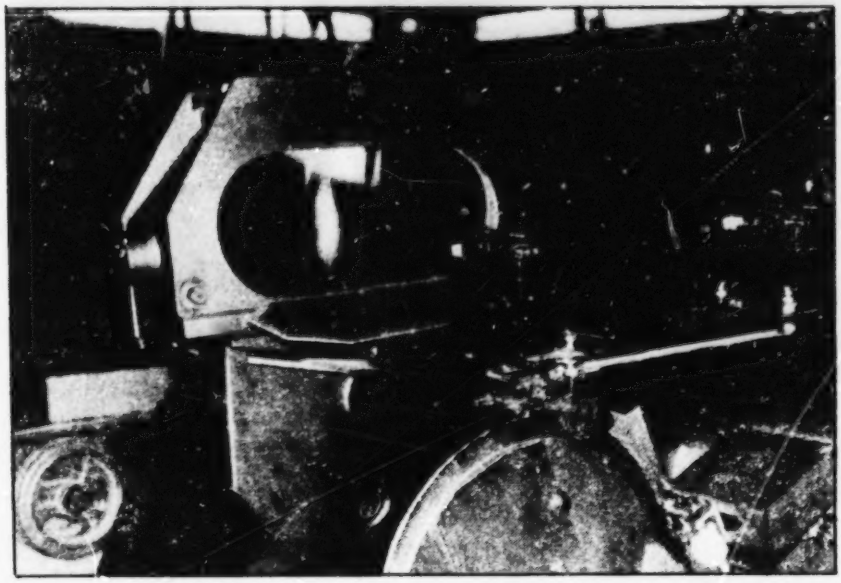
The telescopes with a 2-meter main mirror, which were made at the Karl Zeiss People's Works in Jena before the telescope for the NAO and which are located in the observatories in Tautenburg (GDR), (Onjeiov) (Czechoslovakia) and Shemakha (Azerbaijan SSR) have Coude spectrographs whose diffraction grating is limited by a collimator light bundle 20 cm in diameter.

Our objective was to make the Coude spectrograph of the 2-meter NAO telescope able to make full use of the telescope's optical power. Dr B. Kovachev's design included a collimator with d=20 cm for cameras with respective focal distances of F=875 mm and F=1,900 mm. This made it possible subsequently to place the white light of the collimator bundle in a spectrum of widest possible diffraction grating 306 x 360 cm. The next step was to compute the diffraction gratings which would cover with their spectral intervals and have a maximal light concentration within the given range of the recordable spectral area, from the ultraviolet (approximately 3,200 Å) to the end of the infrared range passing through the atmosphere. The spectrograph's precision slit (with an accuracy of 0.01 mm) and several additional optical-mechanical, electrical and electronic systems are located in the service area, while the collimators, the grating surface and an original structure in which the three cameras, two of which can rotate around an axis and a third which is fixed, operate on the same optical axis, are in a second air-conditioned chamber. Depending on the camera, with a diffraction grating of 632 lines per mm and a correspondingly selected range of concentration of the light (third or second), the instrument provides a dispersion ranging from 2.8 to 18.4 Å/mm.

Skipping technical details, let us merely point out that the Karl Zeiss People's Works in Jena implemented the design perfectly, and that only the spectrograph's diffraction gratings had to be ordered from Leningrad and the Bausch and Lomb Company (United States). In this case, the large holographic gratings were purchased from the Jobin-Ivon Company (France).

In 1979 and 1980 the observatory conducted tests and spectrographic calibrations. Subsequently (mainly in 1981), dozens of high-quality spectrograms of many interesting stars in our galaxy were obtained.

The tests indicated that the NAO has the best Coude spectrograph of all CEMA countries, with which spectrograms of very weak objects are possible. Our calculations indicated that with a 2-hour exposure the image of a Class AO star on the 2" spectrograph opening and density D=0.6, in the 4,000 Å range, with emulsion Kodak 103a-O, stellar spectrograms, from camera 3 with a 2.8 Å/mm dispersion for stars of a magnitude of up to 4.8, to camera 1, with dispersion 18.5 Å/mm, for 9.5 magnitude stars are possible. Borderline values close to the computed ones were obtained in practice. Thus, with camera 2 and dispersion 9 Å/mm we obtained Coude spectrograms of up to 7.4-magnitude stars, which include far more stars than are visible to the naked eye.



Photograph 1. Camera 3 of Coude spectrograph for 2-meter NAO telescope

Now, using the NAO Coude spectrograph, Bulgarian astronomers and many of our foreign collegues invited by the observatory are studying spectral twin stars, variable stars, magnetic stars, hot stars surrounded by gases and gas rings around their equator, metallic stars and others, with the help of a large number of high-quality spectrograms obtained for many of them. This enables us to gather data on the physical conditions and chemical structure of these stars, their radiation spee in space, parameters of orbital elements in spectral twin stars, etc.

The installation of a Zeeman achromic analyzer in November 1981 further expanded the possibilities of this equipment.

Achromatic Zeeman Analyzer For the 2-Meter Telescope Coude Spectrograph

In the course of discussing a plan for bilateral scientific cooperation between our observatories with Dr I. Kopilov, director of the Special Astrophysical Observatory (SAO) with a 6-meter telescope of the USSR Academy of Sciences, I was told by him about the achromatic Zeeman analyzer developed by the SAO. I requested that two analyzers be made, the second for the NAO.

Basically, this is a unit consisting of two Frenel blocks, separated by an Icelandic spar crystal. The light which crosses them splits into right- and left-polarization bundles. The analyzer is placed at the entrance of the rays in front of the Coude spectrograph slit in such a way as to project the two bundles of light on two levels on the slit. Consequently, two instead of

one stellar spectra are photographed. If a magnetic field exists in its atmosphere, the spectral lines which are sensitive to it (magnetoactive) divide into Zeeman components along the wavelength. If the magnetic fields are sufficiently strong, the photographing of two spectra with a Zeeman analyzer makes it possible to record on the plate the displacements of the two σ-components of the lines and to rate the value of the component of the magnetic field along the beam of vision.

The duplicate of a Zeeman analyzer, which was designed and built by the SAO, identical to the one installed on the 6-meter telescope, was brought by Dr Yu. V. Glagolevskiy as a gift to our observatory. Assisted by his SAO colleague Engineer I. D. Naydenov and the members of our observatory Engineer T. Shukerski, Candidate of Physical Sciences D. Kolev and T. Tomov, Dr Glagolevskiy installed the equipment on the Coude spectrograph of the 2-meter NAO telescope. The tests conducted at the observatory in November 1981 proved that the equipment was working well and made possible the study of up to 7th-magnitude stars with a dispersion of 9 Å/mm and the use of Kodak IIaO plates. The accuracy of the measurements, which depends on the sharpness of the spectral lines usually ranges from 90 to 600 gauss in the measurement of 30-40 unblended lines. The spectra are processed when the width of the lines does not exceed 0.5 Å. The analyzer makes possible the measurement of spectral lines within the wavelength interval $\lambda\lambda$ from 3,400 to 4,800 Å. If Kodak IIaO plates are used the measurement interval is restricted to the wavelength area between 3,700 and 4,800 Å.

The tests conducted at the NAO with familiar stars indicated a good coordination between the results and the data on their magnetic fields measured at the SAO and observatories elsewhere in the world.

By broadening the sighting possibilities of the 2-meter telescope, the Zeeman analyzer allows Bulgarian astronomers to work in yet another interesting and promising area of contemporary astrophysical research. The 1982 NAO observations program duly includes the study of stellar magnetic fields with the new equipment. A detailed plan for scientific cooperation between the SAO and the NAO in this direction has been formulated. It calls for the observation of magnetic stars with the 6-meter SAO telescope and the 2-meter NAO telescope on a coordinated basis, and the joint processing and interpretation of results. This will also require joint efforts to improve the method and technology used in spectrographic measurements. New magnetic stars will be looked for (currently there are only slightly more than 100, a figure which is too small for purposes of statistical studies). Detailed studies of stars with interesting characteristics of the magnetic field will be made, such as stars whose measured magnetic field varies along the lines of the different chemical elements. The problems to be studied also include the shape of the magnetic field and the angle of inclination of the dipole axis toward the star's rotational axis. The results of such studies are related to the theory of the origin of stellar magnetic fields. Another equally interesting problem is that of determining the relationship between the intensity of the magnetic field and the extent of chemical anomalies in the structure of stellar atmospheres, which is presumed but has not been studied.

The study of magnetic stellar fields with a Zeeman analyzer will be continued at the NAO in 1982 on the basis of multilateral scientific cooperation among socialist countries and on a bilateral basis with the Astronomical Institute of the GDR Academy of Sciences in Potsdam (Dr Jotken's group).

Stellar Electrophotometer for the NAO 60-Centimeter Telescope

Together with astronomical photography and astrospectroscopy, electrophotometry is one of the modern astrophysical methods used in the observation and study of celestial bodies, which enables us to make high-precision measurements of the brightness of cosmic light sources.

The first electrophotometric observations of stars and galaxies in Bulgaria were made by Candidate of Physical Sciences Al. Tomov, who used an electrophotometer he had built himself, with the 60-centimeter telescope of the Belogradchik Observatory. The NAO has a similar 60-centimeter telescope of the Cassegrain system, which was procured especially for this purpose, and which is particularly convenient for electrophotometric observations. It enables us to observe up to 13th-magnitude stars.

In 1980-1981, on the suggestion of Candidate of Physical Sciences K. Panov, a group consisting of K. Panov, Engineer I. Pamukchiev, engineer P. Khristov, D. Petkov, P. Notev and N. Kotsev designed and made at the workshop of the Astronomy Section with NAO a stellar electrophotometer (EF-1) for the NAO 60-centimeter telescope. Let us point out that when the contract for a 2-meter telescope with a dome and attachments for the NAO was signed with the Karl Zeiss Firm in Jena, the German side declined to produce an electrophotometer, citing the difficulty of its manufacturing.

Essentially, the equipment works as follows: the star identified with the help of the sight directs a light through the Fabri quartz lens, reflected by the telescope's optical system, on the photocathode of the photomultiplier (in this case EMI-9789 B). The resulting electrical impulse with amplitudes of several millivolts is intensified, after which it is recorded by the impulse counter and the printer. The recording equipment for the electrophotometer was made in the GDR.

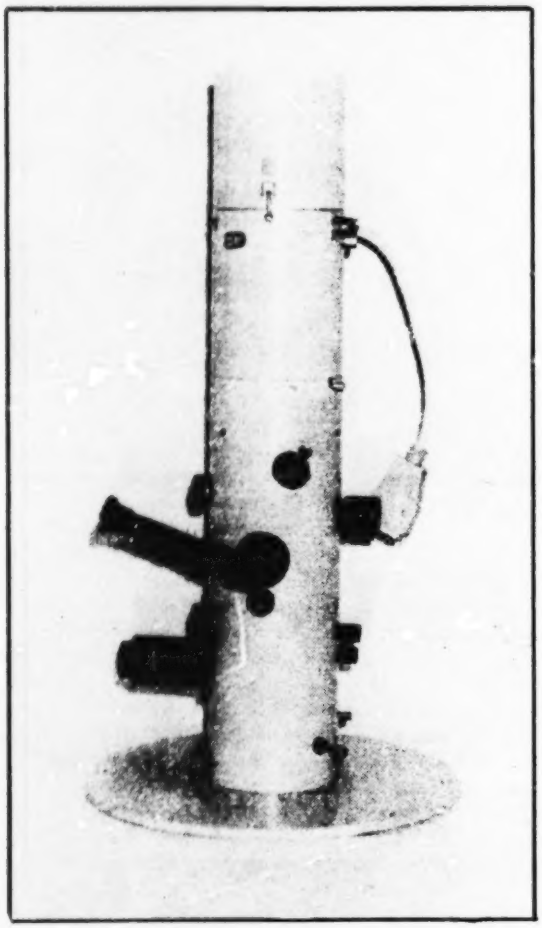
In the course of the observations the source is compared with a standard luminophor and recorded through a set of filters with the help of which specific spectral intervals are photometrically registered.

The studies conducted with the NAO electrophotometer in the autumn of 1981 indicated a recording accuracy of 1/5,000ths of the stellar magnitude (discounting the influence of the atmosphere) and under average atmospheric conditions with 10-second integrations and maximal deviations of 2-3/100ths of the stellar magnitude.

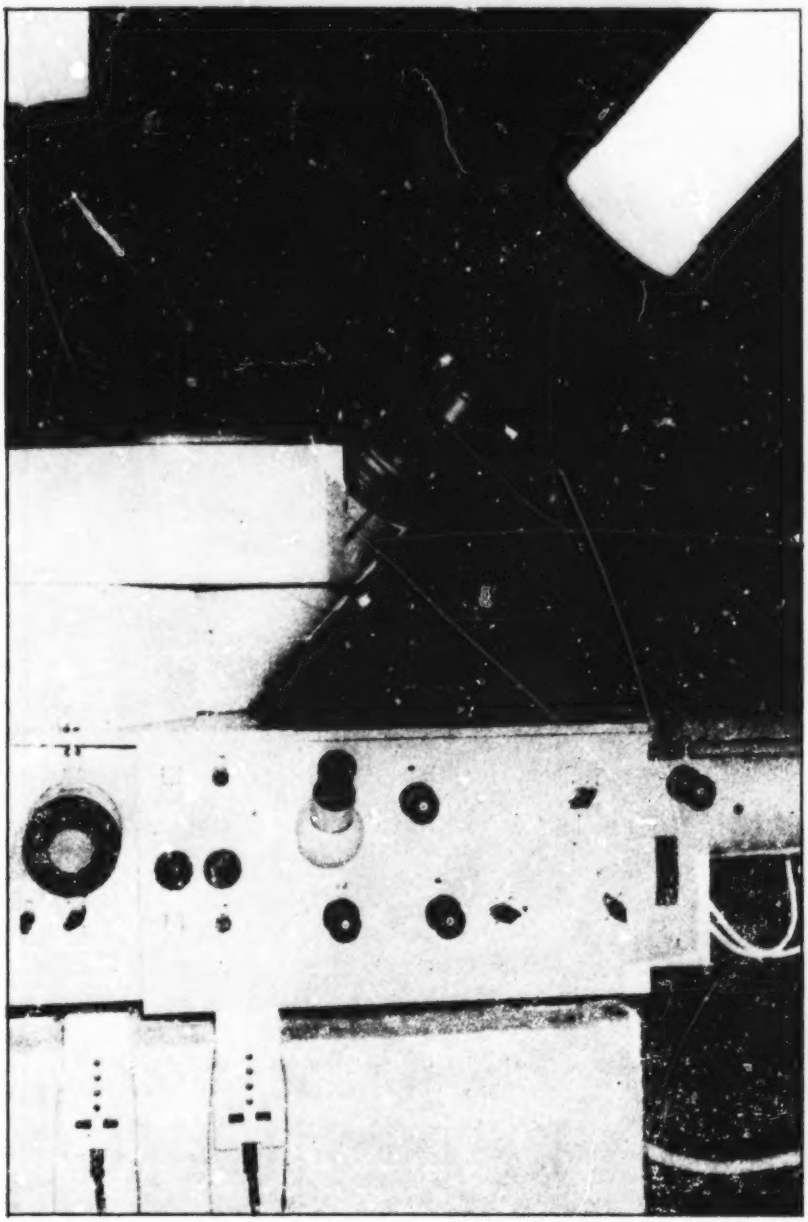
The use of the new electrophotometer at the NAO allows independent electrophotometric observations with the 60-centimeter telescope as well as simultaneous electrophotometric (60-centimeter telescope) and spectral observations (2-meter telescope) of the same body. This broadens the range of information of the studied celestial body. It also makes possible the simultaneous

electrophotometric observations with the Belogradchik and NAO telescopes. A series of simultaneous electrophotometric observations will be conducted by the NAO and neighboring Greece in 1982.

In concluding this brief report on the new recording equipment for the NAO telescopes, let me mention that our main objective at the initial stage of development of the NAO, which will also remain a permanent task for the future, is to obtain high-quality observation data maximally possible in the area of astrophysical observations with the observatory's telescopes. In astronomy, as in many other sciences, this is the basis for accurate studies and for obtaining new results.



Phot. 3. Stellar electrophotometer for the 60-centimeter NAO telescope



Ph. 2. Zeeman analyzer on a Coude spectrograph of the 2-meter NAO telescope

5003
CSO: 2202/13

NEW RESEARCH, TECHNOLOGY DEVELOPMENTS NOTED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 1, 82 pp 82-84

[Report: "Application Proposals and Applied New Instruments, Materials and Technology"]

[Text] Medium Temperature Catalyst for Carbon Monoxide Conversion With Water Vapor

This development is based on three discoveries made at the Institute of Organic Chemistry With Phytochemical Center of the BAN [Bulgarian Academy of Sciences]: Method for obtaining a catalyst for the conversion of carbon monoxide with water vapor (Registration No 28,662/ 6 January 1975); Method for obtaining a medium temperature catalyst for the conversion of carbon monoxide with water vapor (Registration No 37,080/ 3 June 1977); Method for obtaining promoted iron-chromium acid catalyst for the conversion of carbon monoxide with water vapor (Registration No 52,876/ 10 July 1981).

The inventors are Senior Scientific Associate A. Andreev, Corresponding Member D. Shopov, Scientific Associate B. Kunev, V. Idakiev and A. Bankova. A collective at the Economic Chemical Combine in Vratsa, consisting of Candidate of Technical Sciences Engineer K. Petkov, Engineer G. Khristov and Engineer P. Stefanov, assisted in applying and improving the technology.

A method for obtaining a highly active catalyst for the conversion of carbon monoxide with water vapor, containing small quantities of sulfur in fixed condition, was developed. The catalyst will be used in our nitrogen industry for the production of ammonia gas. Its specifications make it as good as the best products of its kind in the world (such as those produced by Gidler, ICI, etc.). Annual savings from the production of the catalyst alone are estimated at about 300,000 leva. Additional results are expected from reducing the time needed by the catalyst to reach a standard operational regimen. Imports from capitalist countries will be terminated. Possibilities exist of our country specializing in the production of the catalyst within CEMA.

The BAN Organic Chemistry Institute has drafted technological rules and plant standards for the production of the catalyst and is actively participating in the application of this development at the Vratsa Economic Chemical Combine.

Regular production is expected to begin at the end of 1982, following the completion of the catalyst shop at the combine, currently under construction.

Technology For the Production of Glucoamylase

The BAN Institute of Microbiology has developed a method for the production of glucoamylase (Registration No 45,809 of 5 December 1979) invented by Senior Scientific Associate T. Kalinov, Engineer I. Ganchev, A. Vicheva and K. Tsekova. The method became the basis of a technology for the production of a glucoamylase enzyme concentrate containing about 50 percent dry matter and effectiveness of 5,000 u/ml. In terms of activeness the product is as good as any glucoamylase preparation in the world.

The enzyme glucoamylase is effective in the production of glucose in crystal, in sweetening starchy products, alcohol production, the production of special beverages, improving the quality of bread products and others.

The production of glucoamylase enzyme is new to our country. Industrial tests have been completed and the preparation will be produced on a regular basis at the G. Dimitrov Economic Chemical Combine in Botevgrad. It will be used at the Geo Milev Starch and Glucose Combine in Sofia (for the production of glucose in crystals) and the Alcohol Manufacturing Factory in Katunitsa Village, Plovdiv Okrug (for the production of alcohol). Some glucoamylase will be used in the production of the Bodrost diet drink, the manufacturing of bakery products, etc. Savings from the cumulative results of the use of glucoamylase are estimated at more than 600,000 leva annually.

'Betatest ST-140' General-Purpose Testing Stand

The general-purpose Betatest ST-140, used in a wide range of research projects and tests of lead traction batteries, was developed at the BAN Central Laboratory for Electrochemical Power Sources. Its use in plants and research laboratories makes improved plant control quality and faster scientific research and application in the field of lead batteries possible.

The stand is part of the system of instruments and technical facilities for the study of Betatest current. It is also part of the set of testing stands. Betatest ST-140 allows the simultaneous check of six operating cells with a power of up to 400 ampere-hours in different testing systems based on GOST, DIN, BDS and SAE for durability, capacity, recharging, testing in "floating" batteries, efficiency, specific energy features and other battery parameters.

A central processor ensures the use of Betatest ST-140 in various work systems such as galvanostatic (G), potentiostatic (P) and combined (P or PGP), the latter being used for shileding the tested item.

Remote control makes its use in a broad range of other research tests possible.

The Betatest ST-140 general-purpose testing stand has the following technical data: Number of simultaneously tested cells -- 6; control accuracy -- 0.2 percent; minimal charging tension (regulated) -- 14-17 V; operational

systems -- manual, automatic and remote control; control system -- G, P, PGP; capacity measurement -- automatic and in percentage figures; power -- 360 ± 10 % 50 Hz; size 1,000 x 1,000 x 2,000 mm; weight -- 240 kg.

Surface Dynamic Compacting of Loess Sinking Soil With a 15-Ton Compactor

A method for compacting sinking ground for construction purposes consistent with local conditions has been developed and applied at the BAN Laboratory for the Geotechnology of Weak Earthen Foundations and Grounds, under the guidance of Prof M. Minkov. Because of the great depth required for effective compacting of the surface (from 3 to 6 m depending on the loess soil) and the low resistance of the compacted areas, this method can be applied in cases of sinking earthen foundations first and second type, with a thickness of the sinking area of up to 10-12 m, which are quite common in the country. The safe distance to existing buildings is 10-20 m. Our equipment allows to raise the compacting weight to 20-25 tons. This increases the depth of the effective compacting and expands the area of application of the method. Instructions on the controlled application of the method will be drafted at the stage of its expanded application. The method is highly scientific. It was applied in countersinking foundation works in the construction of large projects in Ruse Okrug. Excellent possibilities exist to extend the use of this system to construction in areas with widespread loess sinking foundations.

5003
CSO: 2202/13

BRIEFS

LASER-FIBER OPTIC COMMUNICATIONS—The Technical Physics Research Institute of the Hungarian Academy of Sciences [MTA Muszaki Fizikai Kutato Intezet] is conducting research on lasers for communications with good results. Preparations for production of light-conducting optical fibers are underway at the Hungarian Optical Works [MOM]. At the same time the Postal Experimental Institute [Posta Kiserleti Intezet] is concerned with introduction in Hungary of fiber optical communications equipment. The technology for fiber optical communications equipment based on lasers was developed abroad between 1974-1980. Although the Hungarian Post Office does not use lasers, it has been using the new type of PCM transmission with fiber optics successfully for years. It will soon put an experimental network using lasers into operation. This will help domestic research, development, production and utilization close the gap between it and international achievements in the field of fiber optics communications. [Excerpt] [Budapest NEPSZABADSAG in Hungarian 29 Jun 82 p 10]

CSO: 2502/84

POLAR RESEARCH DEVELOPMENTS DESCRIBED

Remote Sensing Methods

Warsaw CZASOPISMO GEOGRAFICZNE in Polish No 4, Oct-Dec 81 pp 379-396

[Article by Kazimierz Furmanczyk, Gdansk University Institute of Geography, and Jacek Jania, Silesian University Institute of Geography: "Remote Sensing Methods in Polar Research"]

[Excerpt] Abstract. This paper attempts to present systematically the development of applications of remote sensing methods (including air and ground photogrammetry) to study the geographical environment of Polar regions. Special attention is paid to a historical review of Polish work in this area. The results of the Polish Antarctic expedition during the 1978-1979 season are stressed. In the expedition to King George Island in the South Shetlands, a multi-spectral camera, mounted on a Mi-2 helicopter, was used to take photographs. This article includes an example of a computer study of these photographs for charting vegetation distribution. The collected and systemized material from the literature as well as the authors' own Polar experiences and research permit the differentiation of the main stages of development of applications of the described methods in the Arctic and Antarctic as well as an evaluation of the state of Polish work in this area.

Introduction

Polar research in the various branches of natural science is affected by the relative inaccessability of the terrain being investigated, difficult or very difficult weather conditions and limited time for scientific exploration because of the lack of sunlight during the Polar winter. The difficulties of Arctic and Antarctic (water) research imposed by nature means that the cost of expeditions and research are very high, and direct terrestrial observation is limited usually to the Polar summer season. But some fields of geography, geophysics and biology require continuous, uninterrupted research throughout the entire year. These investigations are accomplished at permanent research stations operating in summer as well as in winter. Poland has two such stations: on Hornsund Fjord, Spitsbergen Island, in the Arctic Ocean and on Admiral Gulf, King George Island, in Antarctic(land).

An important goal of the tasks undertaken for regional compilation during the Polar summer is to investigate the variability of objects in space and time. Remote sensing methods are modern research tools that overcome the barrier resulting from the severe Polar environment. Remote sensing, based on recording and interpreting information about the natural environment carried by electromagnetic radiation, is defined in various ways. In the Polish literature, Andrzej Swiatkiewicz (1978) offered a good proposal for a comprehensive definition of 'nontactile' research methods. In his view, remote sensing is a group of methods that permit the nature or state of objects and phenomena, as well as their interdependence with the surrounding area, to be determined based on recording the electromagnetic radiation energy of the investigated objects and properly interpreting the recordings. Determining the nature of objects depends on determining their physical-chemical or biological structures, and investigating their state depends on transmitting geometric, topographic, physical or physiological characteristics. Observations via remote sensing methods for earth science needs are done from the decks of spacecrafts or from ground stations. Remote sensing is divided into various divisions depending on the electromagnetic radiation wavelength used or the method of collecting and recording this radiation. Ordinarily the following methods are differentiated: conventional black-white photography; conventional color photography; unconventional photography (infrared, spectro-zonal and multispectral); methods using nonphotographic passive techniques--television, scanner and radiometric as well as active techniques--radar, laser, acoustic (when investigating the sea bottom) and others. All of these pictoral methods of recording radiation emitted from the earth's surface can be and are used in Polar research. The conventional photographic techniques are the most extensively used for the longest time period.

The purpose of this paper is to present the most important stages in the development of applications of remote sensing methods in the exploration of Polar regions with special consideration for Polish research. The authors based their work on the literature, archival charting material and photogrammetric photographs as well as on their own research and observations on Spitsbergen Island and King George Island. The verbal accounts of colleagues are also utilized--members of the Polar Club of the Polish Geographical Society. This article does not consider the problem of using 'nontactile' methods in specific natural science branches because the problems of each of these disciplines would require a separate, extensive and critical study.

Polish Remote Sensing Operations in the Arctic and Antarctic

The application of remote sensing methods in Polish Polar studies for investigating the geographic environment is much more modest than those of such polar and remote sensing potentates as the Soviet Union or the United States. Nonetheless, the Polar expeditions organized in our country used remote research methods from the start to investigate terrain. The second independent Polar expedition, which labored during the summer of 1934 in Torrell Land on Spitsbergen under the direction of Eng Stefan Bernardzikiewicz, included Antoni Rogala-Zawadzki on its team. He conducted the ground

photogrammetric operations using a Zeiss C 3b camera with a 13X18 format and a 193.42 mm lens. Maj Stanislaw Zagrajski conducted the triangulation measurements. The photogrammetric station was fixed by reverse intersection, base lengths were measured parallactically, and for base lengths greater than 300 m both stations were fixed trigonometrically. Also, 70 control points were surveyed using the intersection method. Altogether photographs from 22 stations were taken which provided 56 sterograms encompassing an area of almost 350 km^2 [Zawadzki, 1934]. For glaciological, geomorphological and geological observations, 148 individual photographs were also taken. All ground operations were accomplished from June to September. These materials were studied at the WIG [Military Geographic Institute]. In 1935 the WIG published a 1:50,000 scale, two-color map of the terrain explored by the expedition [Zawadzki, 1936].

During the 1937 expedition to Western Greenland, directed by Dr Aleksander Kosiba, Maj Antoni R. Zawadzki busied himself with the photogrammetric and triangulation operations. He took 226 ground photographs from 9 stations and 262 individual photographs for special investigations. During the expedition an area of about 300 km^2 in the region of the eastern edge of Arfersiofik Fjord was mapped. Repeat photographs were taken from those same stations to observe the dynamics of the changes occurring on the surfaces of a continental glacier as a result of ablation. In some cases, six photographs were taken of the same phenomenon at weekly intervals. The tempo of geomorphological processes in the fjord's shore zone was investigated in a similar way. The geodetic measurements and photogrammetric materials were sufficient to draw up a primary map on a scale of 1:50,000 and detailed maps of terrain fragments encompassed by the searching investigations (on a scale of 1:2,500 and 1:20,000) [Zawadzki, 1938]. The photogrammetric work of the 1937 Greenland expedition is an example of a useful application of a remote sensing method to resolve specific glaciological, geomorphological and other problems.

The next operation using this method was conducted during the Polish expeditions to Spitsbergen during the summers of 1957-1959 that were directed by Doc Stanislaw Siedlecki within the framework of the Third International Geophysical Year. The photogrammetric work was executed by Eng Cezary Lipert, and the geodetic network measurements were taken by Dr J. Fellmann, Eng J. Staszel and Eng M. Gasienica. A detailed 1:5,000 scale topographic map based on photogrammetric photographs of the head zone of the Werenskiold Glacier was developed [Lipert and others, 1961]. Just as in the prewar expeditions, in addition to photographs for a primary map, smaller fragments of the terrain were also photographed for special research needs. An important goal of these glaciological studies was to determine the rate of recession of the glaciers around Hornsund Fjord [Lipert, 1960]. A station to systematically photograph the Hans Glacier near the Polish Polar station on Polar Bear Bay was permanently fixed in 1957. Repeat photographs were taken from these stations in 1958 and 1959. The state of the heads of Horn and Torell Glaciers were similarly recorded. In addition, the circus area of Penck Glacier was remapped [Lipert, 1981]. These studies were the greatest Polish photogrammetric project in the Arctic after World War II. The photographic materials were used not only for topographic mapping

but also as an aid in many glaciological, geomorphological and geological studies. To this day they represent invaluable comparison material for further research of South Spitsbergen Island, similar to the results of the Polish studies in 1934 and the German research on Sorkappland [Pillewizer, 1939]. Lately an attempt has been made to develop more completely the 1959 photogrammetric material on the head of Hornsund Glaciers to obtain information concerning the fluctuations of these glaciers. The Norwegian aerial photographs taken in 1978 are also being used [Jania, Kolondra, Lipert, 1981].

Regarding other Polish Polar photogrammetric studies, the participation of Eng T. Konysz in the 1968 expedition of the Polish Geographic Society to Iceland should be mentioned. The foreland of Skeidararjokull Glacier was charted to a 1:5,000 scale with the aid of photographs taken by a Zeiss Photheo 19/1318 phototheodolite [Linsenbarth, 1974].

In the framework of the reactivated expeditions to Spitsbergen, organized by Wroclaw University under the direction of Dr Stanislaw Baranowski, the photogrammetric studies of the head of Werenskiold Glacier were repeated (a 1:10,000 scale unpublished map) and measurements of the head of the Hans Glacier were repeated.

Eng Zbigniew Mechlinski, a photogramist, participated in the 1978 expedition of PAN [Polish Academy of Sciences], the goal of which was to reconstruct and reactivate permanent scientific activity at the Polish Spitsbergen station in the Hornsund region. He executed a series of photogrammetric charts of the head zone of Werenskiold Glacier which were used to develop a 1:5,000 scale map [Mechlinski, 1979].

In that same year, the Second Polar Expedition of Silesian University operated on the southern shore of Hornsund Fjord. Ground based remote sensing operations were conducted there to analyze the forms and processes on the periglacial slopes in the Gasdalen region and the processes shaping the surface of Nordfall Glacier [Jania, 1979]. The photogrammetric photographs were executed with a Photheo 19/1318 camera on the basis of which large-scale 1:5,000 cartographic bases were developed. From these same stations a series of photographs were taken at 2-week intervals with a Kiev 80 camera having a 6X6 cm format with replaceable cassettes on film. Panchromatic, color-reverable and near infrared photographs were taken. Stereoscopic, repeated ground-based photographs of test fragments of the slope and glacier enabled typical forms on the slopes to be defined and the dynamics of some slope processes to be observed. The use of infrared sensitive film made it easier to determine the role of increased humidification of slope coverings in modeling the investigated periglacial slopes [Jania, 1979b, 1981].

In the following year, during the PAN expedition to Spitsbergen, geodetic and photogrammetric measurements were taken in the area near the Polish station on Hornsund (Dr Witold Mizerski), and in the summer of 1980 photogrammetric photographs were taken of the heads of Hans and Horns Glaciers [Dabrowski, Mroczek, 1981].

In addition to the above-mentioned studies, there is much interest on the part of Polish geologists, geomorphologists and other specialized naturalists in the terrain and in the field of interpretation of the Norwegian panchromatic aerial photographs of Spitsbergen (for example, Sendobry, Sinkiewicz, 1979; Andrzejewski, Stankowski, 1981; Marks, 1981], and earlier in the Iceland region [Klimek, 1972; Churski, 1974]. Interest is also increasing in the use of radar techniques to determine the thickness of glaciers. Polish glaciological work in the Hornsund region is being aided by Soviet radar cross-section work being done with helicopters [Moczeret, Zurawlow, 1980], and at the same time interesting tests are being conducted on the Hans and Werenskiold Glaciers using a ground-based radar with great success [Czajkowski, 1980, 1981].

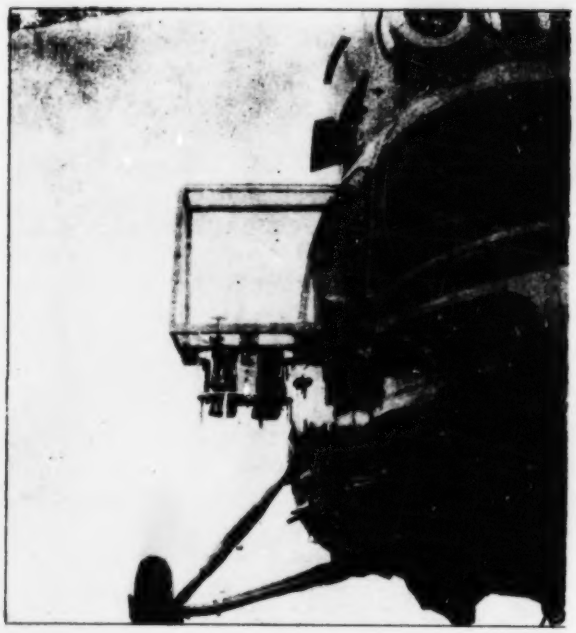


Figure 1. A Mi-2 helicopter with a multi-spectral MSK 4/6.6-1UG camera at the H. Arctowski Polar station.

In Polish Arctic research, a material limitation in the use of remote sensing methods is the lack of airborne equipment and also the difficulties of obtaining in Poland aerial photographs of Spitsbergen and other areas visited by our expedition.

A receiver of meteorological satellite images was installed at the Polish H. Arctowski Antarctic station on King George Island during the 1977/1978 Second PAN Antarctic Expedition. The pictures taken by Krzysztof Zubka from January through March 1976 from the NOAA-5 Meteor-22 and Meteor-23 satellites were studied from the viewpoint of observing the effect of the orography of the South Shetlands and Graham Land on cloudiness. The results of the study were reported in a paper presented at the Seventh Polar Symposium [Boniewicz, Kumoch, Zubek, 1980]. During the 1978/1979 season the reception was supervised by Leszek Kumoch [Rakusa-Suszczewski, 1979]. They were used immediately for synoptic purposes and after being interpreted in Poland they were used for climatic and actinometric analyses.

The two 1978/1979 PAN Antarctic Expeditions were of historical significance. For the first time in the history of Polish Polar research, helicopters were used and pictures of King George Island and Bunger's Oasis were taken from the helicopters. Eng Zbigniew Battke took aerial photographs at the A. B. Dobrowolski Station, Bunger's Oasis. He operated an AFA BAAF 21S nonphotogrammetric camera having a 210-mm focus and a 13X18 negative format that was installed on a Mi-2 helicopter. Photographs were taken of the marginal zones of Antarctic's continental glacier in contact with Bunger's Oasis and of the immediate surroundings of the station. In addition, a proper structure for the photopoints was established [Cisak, 1980]. As a result of this research, a 1:5,000 scale map of the region near the A.B. Dobrowolski Station as well as a 1:5,000 scale photosketch of all the photographed regions were developed. They will be used, among other things, to investigate the dynamics of the continental glacier's marginal zones; in addition a comparison of the Polish studies with the aerial photographs taken in 1956 by the Soviet expedition is planned [Battke, 1980].

During the third PAN expedition, directed by Doc Stanislaw Rakusa-Suszczewski at the H. Arctowski Station, aerial photographs were taken from two Mi-2 helicopters. The first Polish aerial photographs of the Antarctic region were taken 14 December 1978. Franciszek Wozniak took pictures of the Admiral Bay region and of a small, volcanic islet of Penguin Island for the PAN Insitute of Ecology using AFA BAAF 21S and AFA 39 camera. Photosketches were prepared by many groups of biology and earth science specialists [Rakusa-Suszczewski, 1979]. Dr Dazimierz Furmanczyk took multi-spectral, color, panchromatic vertical and oblique aerial photographs to prepare interpretational thematic maps of the ocean and land environments and to locate selected types of flora and fauna in the Admiral Bay region [Furmanczyk, 1979]. The multi-spectral photographs were taken with a MSK 4/6.6 1UG multi-spectral camera constructed at Gdansk University from four Kiev-80 cameras having a 6X6 cm photograph format, replaceable cassettes and objective lenses of 45, 90 and 250 mm. Detail descriptions of the cameras, utilized filters and films and photointerpreting work conducted at the H. Arctowski Station are presented in a separate report [Furmanczyk, 1981]. The panchromatic and

Figure 2. Aerial photograph of the H. Arctowski Station (King George Island) made with a multi-spectral camera in band 1--red (February 1979)

color film slides were taken with Pentacon Six TL and Practica LLC cameras. In combination with a U.S. navigation map, these photographs permitted the recording of changes in the locations of the present glacial shorelines relative to their locations about 20 years earlier and the preparation at Gdansk University of a 1:25,000 scale situational sketch of the entire Admiral Bay region that takes into account the indentations of the structure points taken during the first expedition in 1976/1977 by Dr Kazimierz Fedak [Furmanczyk, Marsz, 1980]. These photographs were also used to interpret the distribution of macro-algi in the shoreline zone, to localize bird breeding colonies, to localize concentrations of elephant seals, to determine the extent of vegetation distribution and to localize the outflow of fresh

water into the bay and changes in its surface area. Some of the results of these studies have been published [Furmanczyk, 1979, 1980, 1981; Rakusa-Suszczewski, 1979], and others are in the process of compilation. Figure 2 is an example of one of the multi-spectral photographs of the area around the H. Arctowski Station. A Gdansk University computer with specially composed programs was used to interpret this photograph. The photograph was converted into a digital form having 0.2X0.25 mm elementary fields (pixies) using a CSPO-01 digital image scanning converter which also was built at this university. Figure 3 shows the results of this interpretation in the form of a digital thematic map. The fact should be emphasized that this is the first map of its kind developed from Polish aerial photographs using Polish equipment and Polish computer programs. It was prepared in the fall of 1979.

[see Figure 3, next page]

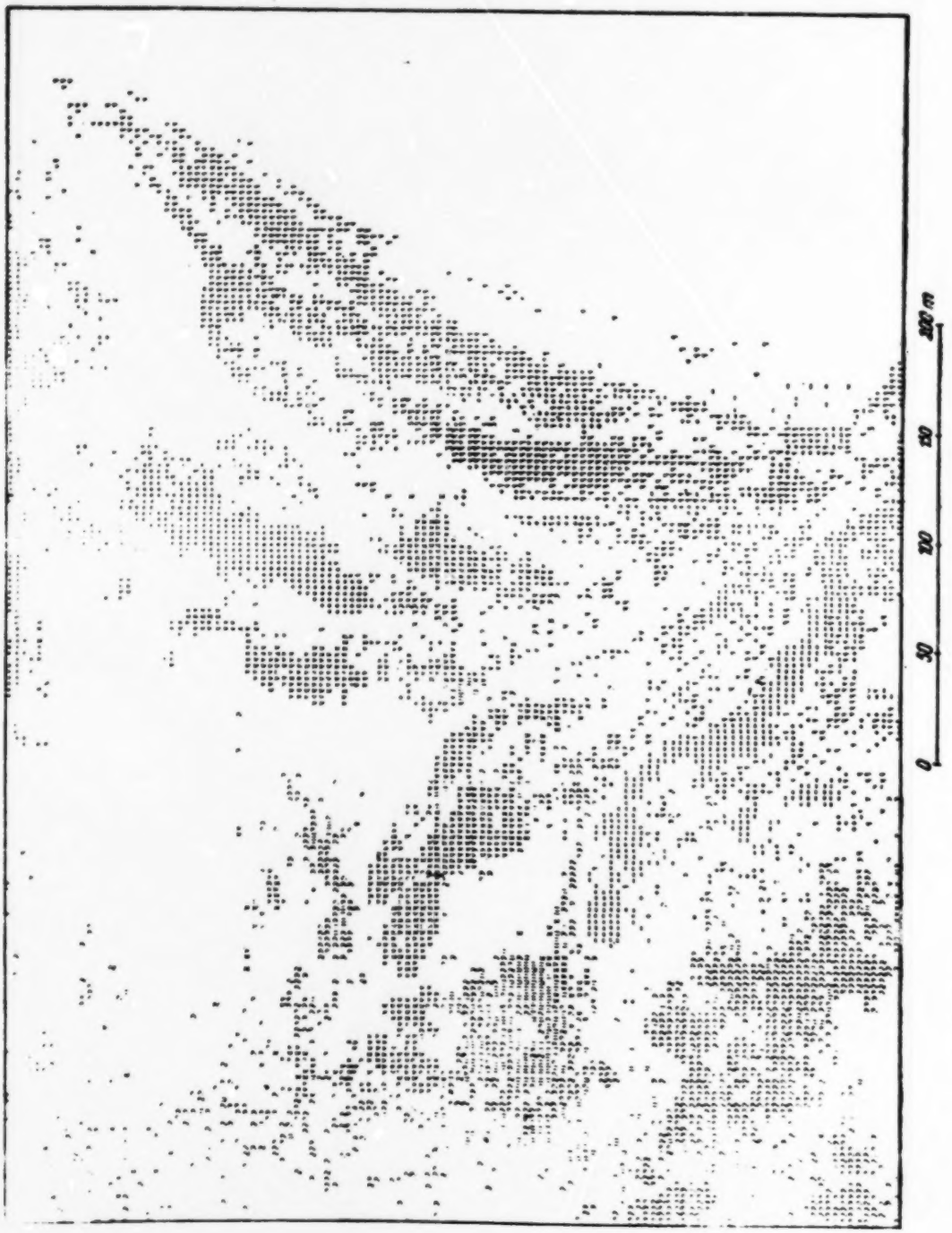


Figure 3. Digital thematic map of vegetation distribution in the area near the H. Arctowski Station that was made in the autumn of 1979 by way of computer analysis of multi-spectral photographs using the Odra 1204 computer at Gdansk University.

According to the expedition report [Rakusa-Suszczewski, 1979], all the aerial photographs were helpful to Doc Andrzej Marsz [1979] in studying the typology of the seashores to prepare a 1:25,000 scale navigation map, which is a supplement to the U.S. map. During this same expedition, Dr Jacek Piasecki conducted glaciological research using a Photheo 19/1318 camera. It was the Polish expeditions in which remote sensing methods were first used to analyze so many elements of the geographic environment.

Conclusions

1. Remote sensing methods were used by the Polar countries somewhat earlier in comparison with their wide use in Europe and America. In particular, photogrammetric methods were verified earlier in the Polar regions in a satisfactory way. It can even be stated that Polar exploration was the stimulus for developing some remote sensing methods.

2. In the development of applications of remote sensing methods to research Polar regions, several periods can be differentiated:

--the earliest period (the beginning of the 20th century) in which the use of ground-based photogrammetry to chart the Arctic and Antarctic predominated;

--the period starting with the initial use of aircraft for photogrammetric charting (the detection and charting of large areas of the Arctic and Antarctic);

--the period wherein only aircraft are used to take black-white, color and multi-spectral aerial photographs; and

--the period in which the use of non-photographic image recording from aircraft and satellites was initiated (the 1960's).

3. The use of remote environment research methods in Polar research activities evolved through stages similar to those described above but with delays and limitations resulting from the lack of technical resources, especially airborne equipment. However, it should be remembered that Polish studies in the 1930's concerning Spitsbergen and Greenland resulted in some of the first detailed photogrammetric photographs of these regions.

4. Remote sensing methods are a very economical method for Polar investigations and permit comprehensive investigations of relatively large areas in a short time period, and compiling the results takes place in Poland under laboratory conditions after the expedition returns.

5. A certain disproportion still exists between the modest use of remote sensing methods and the scale of the research problem resolved by the Polish expeditions. It appears that it is necessary to revise research plans to include the more extensive use of remote sensing methods, which are an excellent and essential compliment for most terrestrial research.

Arctic Minerals, Fishing Claims

Warsaw RZECZPOSPOLITA in Polish 13 May 82 p 4

[Article: "Research Among the Polar Ices"]

[Text] Poland has been conducting Polar research for many years. And despite difficult economic conditions, we will continue these investigations although, of course, on a smaller scale in accordance with our capabilities. This is the only way we can maintain our present and future advantages, scientific and economic, that result from a presence in that part of the world.

Polish fishermen have been fishing in Antarctic fisheries since 1977, and in the future there is the possibility that valuable mineral resources, especially crude oil and gas, will be discovered in this area as well as in the Spitsbergen region.

In accordance with international conventions, only those countries actively participating in scientific Polar research have the right to eventually benefit from expected discoveries. The first political conference on this theme was held in 1980 at which the Polish delegation emphasized our right to share in the benefits brought about by discoveries of deposits, for example, crude oil. We have full rights as a result of our many years of active scientific work. The situation regarding the exploitation of Arctic fisheries looks the same.

Our country is a signatory to the Treaty on Antarctic Affairs, and in 1977 we became a member of a group of nations--The Consulting Countries for the Treaty--representing an international body making decisions on shaping the future of Antarctic(water) and its surrounding seas (up to 60° latitude south). One year later the PAN [Polish Academy of Sciences] became a member of SCAR (Special Committee for Antarctic Research), an organization directing and coordinating the scientific activities in the Antarctic area of all the member countries.

For over 90 years, Polish interest in the Arctic was traditionally limited to Spitsbergen. Now we are conducting research in the Greenland and Barents Seas. In the region's Spitsbergen shelf there is a promise of hydrocarbons (crude oil or gas), where future exploitation could be a subject of interest to companies with Poland's participation.

Poland is working closely with other countries in the area of Polar research, especially with the Soviet Union. Both our countries are the only nations from the socialist camp participating in the treaty on Antarctic research affairs.

The PAN has prepared a more modest Polar research program for the next several years up to 1985 than for previous years. As we mentioned, this is linked to our economic difficulties. However, operations at the Arctowski station on Antarctic(land) and on Hornsund, Spitsbergen Island, will continue. We also will take part in the international program for polar oceans research.

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CSO: 2606/19

CRISIS IN COMPUTER APPLICATION DESCRIBED

Warsaw INFORMATYKA in Polish No 1, Jan 82 pp 4-6

[Article by Tadeusz Walczak, Main Office of Statistics, Warsaw: "Information Science in a Period of Changes"]

[Text] The current critical situation in Polish computer technology has arisen owing to various factors stemming from both inside and outside the computer industry. The correct identification of its causes is, for obvious reasons, of basic importance not only to correct diagnosis of the existing situation but also--and perhaps primarily--to the determination of future directions and prospects.

The present article will chiefly deal with computer applications, although it is obvious that problems of application cannot be considered in isolation from other aspects of the subject, and especially from the production and operation of hardware, qualifications of personnel, or materials supply.

The symptons of the growing crisis in computers are chiefly the declining rate of the installation of new computers, the curtailment of computer exports, the absence of progress in the utilization of equipment, and the stagnation in the employment of computer experts. Some of these aspects are illustrated in Table 1.

Table 1.

	YEAR					
	1975	1976	1977	1978	1979	1980
Number of large and medium computers	514	623	708	756	812	857
Percentage increase over preceding year	--	21.2	13.6	6.8	7.4	5.5
Number of minicomputers	430	924	1,182	1,336	1,470	1,776
Percentage increase over preceding year	--	114.9	27.9	13.0	10.0	20.8

Employment in computer centers [thousands]	41.3	47.1	51.0	56.2	56.9	57.1
Percentage increase over preceding year	--	14.0	8.4	10.1	1.3	0.0

Beginning in 1977 a marked decline in the number of new computer installations can be observed. To be sure, this number continued to increase in absolute figures, but this has been accompanied by aging of the computer pool. This is clearly seen from the figures on the percentile structure of (large and medium) computers by age (Table 2). Assuming that computers should be withdrawn from operation after about 8 years, recently the deliveries of new computers did not even offset the number of those withdrawn from operation. For example, the difference between the number of new computers installed in a given year and the number of computers in use for 9 and more years was (in minus terms) -57 computers in 1978, -77 in 1979, and -135 in 1980. Actually then, even the natural depreciation of the computer pool was not offset.

For several years as well there has been no progress in the utilization of computers. Table 3 shows the utilization of computers measured in terms of their operating time (on bearing in mind the conditional nature of this indicator). As can be seen from the data in this table, large and medium computers have on the average been utilized for an amount of time equal to less than two work-shifts daily, and minicomputers--less than one work-shift daily. These data comprise the total operating time, that is, the so-called network-hookup time, which includes both production time (inclusive of maintenance) and down-time (due to technical or organizational reasons.)

Table 2.

	Year		
Age of Computers	1978	1979	1980
1-3 years	30.3	21.6	18.3
4-5 years	31.7	29.8	22.8
6-8 years	24.0	32.1	37.9
9-10 years	8.3	9.0	11.8
11-15 years	5.0	6.9	9.2

Table 3. Overall Operating Time of Computers, in hours per work day

	Year			
	1977	1978	1979	1980
Large and medium computers	13.2	13.1	13.3	13.1
Minicomputers	6.0	6.5	6.4	6.3

The division of overall time into actual operating time and down-time in hours per work day is shown in Table 4.

Table 4.

	Year			
	1977	1978	1979	1980
Large and medium computers:				
--Operating time	10.6	11.0	11.1	10.9
--Down-time	2.6	2.1	2.2	2.2
Minicomputers:				
--Operating time	3.4	4.4	4.4	4.3
--Down-time	2.6	2.1	2.0	2.0

The above figures point to an increasingly unsatisfactory situation in the field of computers and their applications, which even now causes a deterioration in the quality of the computer service and is a foretaste of still greater problems to come. The unfavorable aspects also include problems in complementing final computer assemblies, which are keenly felt by the computer centers. The domestic industry is implementing consistently and successfully a monopoly dictate forcing users to accept not what they need but what is convenient and profitable to the producers. This results in the use of incomplete and internally unbalanced--from the standpoint of computing capacity--computer configurations which make it impossible to utilize the capacities of multi-program operation and activate more advanced processing programs or systems utilizing a common database.

The situation with regard to the supply of software to computer centers is very difficult. This applies chiefly to line printers, color tapes for printout equipment, and all kinds of data carriers. In many cases the critical supply situation of the computer centers causes equipment down-time and the failure of the centers to fulfill their contractual obligations to customers.

An even more alarming problem than that of the stagnation described above is the increasing crisis of public confidence in computer science. This crisis, difficult to assess by means of quantitative indicators, is chiefly expressed in the disappointment of users with the results of computer applications and in the conviction of computer experts that their efforts are not producing the

expected social and economic results, since the information provided to users is not being effectively utilized.

In computer technology, in particular, there exists a disproportion between the tremendous potential of the equipment, the ability to perform millions of operations per second and to remember an unlimited amount of information, which so stirs the human imagination, on the one hand, and the data-processing practice, on the other. This disproportion is often used as an argument against computerization. If, however, this problem is approached without bias, it turns out in a large majority of cases that the information on the capabilities of computers (as expressed in terms of technical parameters) is not exaggerated at all, and that the failures of application stem from mistakes in the selection of computers or their configurations, or from failure to provide the right conditions for the proper utilization of computers.

Users often forget that the acquisition of a computer is only part of the investment needed to modernize an information system. A much more difficult and often as costly part is to provide the proper conditions for its utilization. A user could avoid many difficulties and disappointments if he were to formulate in advance as accurately as possible the principal purposes and tasks for which he is acquiring a computer.

Computers used in management usually are expected to accomplish two principal purposes. The first is to increase the operating efficiency of the data processing system and to obtain information at lower cost. But the second is that, owing to the application of computer technology, the user should improve his basic performance (reduction of production cost, improvement in quality of products).

The degree to which the first purpose is achieved may be termed the efficiency [English term used] of computer technology. The criterion for achieving the second purpose is termed effectiveness [English term used]. For most cases of application both these purposes are accomplished at the same time. An efficient system is at the same time effective. For it has to be assumed that the data processing system, which is a function of the management system, fulfills its tasks in accordance with the principal purposes of the organizational unit which it serves. It may happen, however, that a data processing system is effective without meeting the criteria of efficiency. By way of an example, computerized airline booking systems or bank savings account monitoring systems may have a low efficiency as expressed in terms of utilization of discrete computer accessories, but the effectiveness of these systems, as expressed in better utilization of vacancies, curtailment of idle flights, better customer service, reduction of public losses of time on waiting in lines, improved customer relations, etc., can be high.

Sometimes, unfortunately, what happens is the other way around: an extremely well utilized, that is, efficient data processing system may be ineffective. A user's failure to utilize, or improper utilization of, the data provided by that system is besides one of the main reproaches addressed by computer experts toward data users.

The acquisition of the needed data within the time period required is a major requirement for efficient management of socio-economic activities at different levels of management. But it is not the only requirement. What is also needed is that the management of organizational units adopt decisions correcting the deviations indicated by the received information and optimally implement the basic tasks of the organizational unit. Otherwise, even an optimally functioning information system will not enhance the effectiveness of management and will not justify its financing.

The inaugural issue of the periodical MASZYNY MATEMATYCZNE (previous title of INFORMATYKA) in 1965 contained an article dealing with the computerization of a planning system for the supply of motor vehicle spare parts. Readers were particularly attracted to a photograph of empty store shelves captioned: "Empty shelves in Motozby [Motor Vehicle Spare Parts Sales Organization] stores. We do not promise that by 1966 all spare parts will be available, but at least it is known for which parts will there be a demand."*

This example from some 17 years ago, as compared with our present-day appraisal of the improvement in the supply of motor vehicle spare parts, may serve to illustrate the aforementioned thesis that even an extremely efficient information system may prove ineffective unless the economic and social factors assuring effective decisionmaking and response to the situations signaled by the information system are geared to it.

Economic Reform--The Chances for Computers

In accordance with the assumptions of the Reform, the principal task of the changes to be introduced is to translate into reality those principles and that operating mechanism of our economy which would assure its high social effectiveness.** This means restoring the importance of economical management and a cost effective approach to every field of management, both on the scale of the enterprises and on that of the entire national economy.

Analogous requirements of effectiveness must be satisfied by measures taken in the field of computers. This will certainly lead to:

--Performing a critical analysis of the so-called large computerized-information systems on provincial and national scale, which should be closely linked to the hitherto mandatory distribution-orders system of management. Most probably, some of these systems will prove dispensable or too costly in terms of the effects of their operation and will have to be eliminated (without any great loss to society and to computer science). For most of these systems so far, only outlays have been made on research and design, but even so in many cases these outlays have been substantial.

---

*Jan Przybylski, "Automation of Behamot Planning," MASZYNY MATEMATYCZNE, No 1, 1965, pp 18-20.

**"Kierunki reformy gospodarczej, projekt" [Directions of Economic Reform; Draft], published by TRYBUNA LUDU, Warsaw, July 1981, p 8.

--A reassessment of the purposes and functions of computer applications in enterprises. It is no secret that in the past in many cases computers were utilized not to meet the needs of enterprises but for other reasons among which a direct factor was the aforementioned misjudged belief that "the computer can do anything" as well as the fears of enterprise managers that they might be accused of obstructing progress, pressures exerted by higher-level units, the use of research and development funds to sponsor the expenditures on computers, and pressures to limit employment exerted by elements of enterprise governing-boards combined with the absence of restrictions on EPD [electronic data processing] expenditures.

The factors mentioned above will most likely result in a temporary decrease in the demand for computers. This will apply in particular to those "thought-up" applications and systems which were constructed to satisfy the inflated ambitions of the authorities and of the information experts fawning upon them rather than to meet the needs of the economy and society. At the same time, the Reform will activate instruments accelerating the directions of action whose implementation logically requires the application of computer technology.

The basic operating principles of enterprises following the economic reform, that is, the autonomy and self-government of enterprises, as manifesting themselves in, among other things, the responsibility of the enterprise's self-government and management for the effects of the decisions taken, will confront enterprises with the inexorable requirements of cost effective management. This will necessitate organizing a reliable and efficient system of internal information. Such a system must assure an operative accounting of inventories and resources, monitoring of co-production agreements and their implementation, calculations of input and output, and the provision of the necessary market information assuring the maintenance of the types and assortment of production geared to the expectations and needs of the customers for the enterprise's products. It appears hardly likely that such an information system could be organized without using computers, especially at the larger enterprises.

A radical increase in the autonomy of enterprises and the curtailment--and where needed, elimination--or directive-type tasks and administrative distribution of resources do not signify dispensing with the need for a centralized adoption of important social decisions in the future. Such decisions must especially pertain to: programs for national development (especially the rate and basic proportions of development), the generation and division of national income, employment policies, incomes and prices, investment activities, housing construction, or economic cooperation with foreign countries. To make possible this centralized steering of the economy, an appropriate data transmission system for transmitting data from the basic economic units to the central-level units must be set up. In this connection, the collection, conversion, and provision of these data will necessitate using appropriate computer systems and data-communications systems.

Another argument in favor of the broad use of computers in these systems is the need to organize direct data flow from the enterprises (for example,

through the mediation of state statistical agencies) in connection with the elimination or revision of functions of the intermediate levels of management (associations) which at present participate in the process of the collection and processing of data transmitted from enterprises to the central level.

There will doubtlessly also occur an increase in the demand of banks for information computer services, in connection with the changes in and broadening of their tasks in the operating system of the economy.

In addition, the applications of computers to consumer service systems should gain markedly in importance. This concerns in particular the postal and telecommunication services, ticket reservations and sales in road, rail, and air transport, loan and financial services, and communal services.

To sum up, following some decline in the demand for computer services owing to the general crisis and the failure of certain previous concepts of computer application, a gradual increase in demand for computer services is to be expected. But in order to make it happen, it is necessary to meet a number of methodological and technical conditions in computer science itself as well as in certain fields of the economy that work for or are closely linked to computer science. This concerns chiefly the removal of barriers which in the past had often--irrespective of objective circumstances unfavorable to an effective utilization of computers--discouraged users from resorting to computers.

--Computer experts must cease regarding computerization as an end in itself and begin to treat it as a method and a means of accomplishing purposes which should be formulated by the users themselves. Hence too a prerequisite for designing and operating an efficient information system that would at the same time satisfy the criterion of effectiveness, as reflected in the streamlining of management and improvements in the performance of organizations, is the active cooperation of data users in the design and introduction of computer systems. In practice, this work is too often entrusted to computer experts without adequate participation or monitoring by information users. Under such conditions, computer experts tend to devise excessively complex systems geared more to the requirements of data processing technology than to the needs of users, while systems users become too dependent on the computerized system and at the same time have no voice in improving it. The users of data needed for management, that is, heads of data departments and elements at all levels, must acquire the ability to find a common language with data systems designers and other experts engaged in the process of preparing the data needed for management. The point is not that data users should penetrate in too much detail into the mysteries of the operation of computer equipment or of programming techniques. Problems of this kind must continue to lie in the domain of experts. But users must learn to understand the language of these experts and rid themselves of the complex of the supposed inaccessibility of computer science and, when needed, to suggest solutions adequate to their computerization needs.

To this end it is necessary to steadily improve knowledge about computers among current and potential computer users, that is, among the broad

community of managers, members of workers' self-governments, students at higher schools of economics and engineering, and teachers who influence the education of the rising generation of specialists in many fields.

--Computer experts should make a greater effort to understand the actual needs of users and propose the application of computers in fields in which their correct functioning is of the greatest importance to users and in which the positive effects of the application can manifest themselves most rapidly and convincingly. This should mean, among other things, the need to introduce data systems that streamline data circulation within the enterprise and assure improved monitoring of the utilization of resources, combatting losses and poor management, or streamlining of employment.

--Computer industry must abandon the position of a monopoly industry which supplies users with hardware and software in the quantity and variety meeting its own needs and requirements rather than those of users, and instead it should adapt itself to meeting the wishes, needs, and possibilities of users. Unless radical changes are made in this respect, all the plans for streamlining and increasing the effectiveness of computers will remain unrealistic.

--There is a need for a fundamental improvement in the quality and reliability of the hardware and software supplied, as well as for increasing the supplier's responsibility for their proper operation. One form of protecting users against poor quality of hardware should be the broad introduction of the equipment leasing principle as well as the linkage of the leasing fees to the actual performance of the leased equipment.

1386
CSO: 2602/21

END

JPRS 81435

3 August 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 750

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3 August 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 750

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SOVIET-ROMANIAN COOPERATION IN PETROLEUM SPHERE DESCRIBED

Bucharest VEAC NOU in Romanian Apr 82 p 4

[Article by Dan Lazarescu: "Do You Know What MOPL Is?"

[Excerpts] MOPL is the name of a new product recently patented as an invention in Romania and in the Soviet Union. The name comes from the combining of the first two letters of the cities of Moscow and Ploiesti. This product, of petroleum origin, intended to protect metals from corrosion, is one of the results of collaboration between the Institute of Research, Technological Engineering and Design for Refineries in Ploiesti and the Union Scientific Research Institute for the Processing of Crude Oil in Moscow. Produced after 3 years of research, MOPL has proven to be an effective means of combating corrosion of metals. At present, work is being carried on in the laboratories of the two institutes to put the final touches on two other products of the MOPL series.

But this is not the only area of collaboration between the institute in Ploiesti and the institute in Moscow. Joint research is being carried on for the devising of processes for obtaining high quality fuels which would also result in a deepening of the level of processing crude oil. At the same time, the participants in the program have proposed to ensure that the new technologies consume much less energy than the methods utilized up to the present. The research takes into consideration the raw materials of each country, so that the technologies devised will be applicable both in Romania and in the USSR and so that they can also be provided to foreign partners.

The two institutes have each been assigned a schedule for each project, on the basis of which the tasks have been divided in accordance with the experience of each institute, their technical resources and the specialization of the researchers. The fact that a number of laboratory experiments, engineering projects and pilot station studies are carried out in only one of the institutes, thus avoiding duplication, leads to a substantial reduction of the research period and a noticeable reduction in expenses.

Other subjects and programs are the object of joint research by the Ploiesti institute and institutes with a similar specialization in Kiev (in the field of lubricants) and Novosibirsk (in regard to a series of catalyzers). But all these things are only a small part of the extensive Romanian-Soviet collaboration which is being carried out in the most diverse fields of activity.

CSO: 2702/14

TEXTBOOK COVERS TOXIC AGENTS, DECONTAMINATION

East Berlin LEHRBUCH DER MILITAERCHEMIE in German 15 Feb 76 No 2, pp 3-7, 9-11, 13, 15-29, 31-46, 49-53, 55-57, 59, 71, 95-96, 195, 249, 287, 295-298, 401, 437, 443, 481-482, 563; 2nd revised edition with 83 tables and 51 illustrations; Military Publishing House of the German Democratic Republic

[Volume 2. Sabotage and Plant Poisons, Detoxification and Detoxification Agents, Analysis of Chemical Warfare Agents and Poisons, team of authors: Chemical Engineer Maj Siegfried Franke (chapters 14-19, new version of chapters 20-23), Chemical Engineer Peter Franz (chapters 24, 33), Professor Dr Gerhard Gruemmer (collaborated on chapters 17-19), Chemical Engineer Lt Col Werner Warnke (chapters 20-23); signed to press on 15 February 1976; 2nd revised edition, 4,000-7,000; Military Publishing House of the German Democratic Republic (VEB), Berlin, 1977]

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[pp 9-11]

One basic concept of the imperialist general staffs is to neutralize the enemy's rear areas in wartime. Here, considerations are not so much aimed at the employment of conventional but rather at the employment of chemical and biological (bacteriological) mass annihilation methods as well as nuclear weapons. The possible use of so-called sabotage poisons takes up considerable space in these considerations.

The idea of poisoning food, water supply plants, consumer items, agricultural crops, and livestock, in order directly or indirectly to harm the enemy, is very old, with a few exceptions, the formerly known poisons permit hardly any large-scale mass annihilation.

Many of the known warfare agents used in combat are suitable as sabotage poisons. This applies particularly to phosphororganyle, Yperite, psychotoxic compounds, and toxic warfare agents. In addition, we know a number of highly poisonous substances which can partly be illustrated synthetically and which partly can be isolated from natural products and are suitable for sabotage. These are mostly compounds which cannot be used as combat warfare agents or which cannot be used because of their physical-chemical properties.

According to the "Dictionary of United Army Terms" [as published] (U.S.A., 1953), sabotage is the action of "agents of sympathizers with the intention of interrupting the war efforts of a nation or otherwise to prevent or to disturb or inhibit the defense of a nation."

Rothschild, a former corps commander in charge of research and development for the U.S. Army Chemical Corps, in 1964 estimated that sabotage is a mighty weapon already in peacetime which, used over a period of time, can lead to the destruction of the people's confidence in its country and its government and which can also be used immediately prior to or upon the outbreak of a war. He credited toxic substances with great possibilities as sabotage weapons and broadened their area of use in support of semistrategic and strategic objectives.

During both world wars, imperialist countries made great efforts to discover substances suitable for sabotage. They did not confine themselves only to poisonous substances but they also looked into bacteriological agents. After World War II, preparations became known for a sabotage war using poisons as

intended by some countries (Germany, Japan, Great Britain, the United States).

If the substances are suitably selected, sabotage poisons can be used already in small quantities by agents, by groups of subversives, by rangers, etc.; they have a great effect and, depending upon their objective, they can cause damage to man, animals, and agricultural crops.

As a result of studies on natural poisons and their analogs which in recent years have been pursued very intensively as well as investigations on their possible synthetic illustration or industrial production, the danger of the use of such substances for military purposes has increased and this means that sabotage poisons must be included in measures to provide protection against mass annihilation agents.

The substances described represent a selection (the sequence of poisons taken up is not based on any system) because the number of compounds to be considered as sabotage poisons is too great. Compounds already covered as chemical warfare agents will not be considered here with the exception of examples.

In general, the following criteria have been established for sabotage poisons to inflict damage on man:

High degree of toxicity both regarding their lethal and also their incapacitating effect;

Adequate resorption capacity through the mucosae of the digestive tract to poison water, as well as essential and nonessential foods;

Good resorption capacity through intact skin surface to poison materials, objects, and clothing;

Colorless, tasteless, and odorless;

Physical and chemical stability, especially depending upon the utilization purpose, hydrolysis and heat resistance;

Solubility in fat and water;

Delayed action in order to poison the largest possible area by the time the first phenomena of poisoning appear and to delay the determination of the source of contamination;

If possible, chemical contamination should not cause any specific pathological changes in the organism which would make it possible to recognize the particular agent;

Unusual toxic effects for which there are no or only inadequate antidotes;

Impossibility of indication in organism and in source of contamination.

These of course are idea requirements which only very few substances meet. The employment objective and the source selected for contamination will be decisive although the available substances last but not least will also be decisive.

Examples involving major cases of food poisoning show the extent which the application of sabotage poisons can assume.

In 1959, olive oil, mixed with aircraft engine oil, was sold in Morocco. More than 10,000 persons were poisoned suddenly.

In 1960, almost 100,000 persons became sick within 10 days in Holland after consuming a margarine mixed with a health-damaging emulsifier.

Here we might also recall the catastrophic effects of so-called gangrene from ergotism or convulsion infection which is now a part of the historical record and which sprang from the use of flour which from time to time consisted of one-third ergot. In the year 994 in France, mass poisoning caused 40,000 deaths. According to history, there were about 300 mass poisoning incidents until the 19th century.

[p 13]

14. Natural Poisons

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[pp 15-29]

14. Natural Poisons

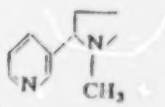
Natural poisons from plants and animals have been known for a long time and were used both for military purposes (arrow poisons, etc.) and in medicine even before their isolation became possible and before their composition became

known. Many natural toxins have not been completely identified and defined to this very day in terms of their composition and constitution. Natural toxins are formed in many different ways, in plants, animals, and microorganisms. The biochemical processes which take place here have not yet been clarified in all cases. Many are more poisonous or just as poisonous as synthetic poisons. In the substances which are of interest here we are dealing with alkaloids or toxins, some of which can be illustrated synthetically or analogs can be made on the basis of their model. All substances already covered under the heading of toxic warfare agents must at the same time be considered as sabotage poisons.

14.1. Poisons of Vegetable Origin

14.1.1. Alkaloids

14.1.1.1. Nicotine



(14.1)

3-N-Methyl-pyrrolidyl-(2')-pyridin

Nicotine is built up in the roots of the tobacco plant (Nicotiana tabacum) and is transported from there into the plant. The plant's nicotine content varies according to the type between 0.5 percent and 8 percent. Nicotine-rich plants, which are cultivated especially to obtain nicotine and to make tobacco lyes [liquors], can contain up to 15 percent.

Nicotine can be illustrated synthetically. The requirement is generally met by the natural product. It is a colorless oil which turns brown in the air. In the purest state it becomes ordorless, Kp [coagulation point? dissociation point?] 246° C (partial decomposition); F [melting point] below -30° C.

Nicotine is soluble in water and organic solvents. It is water-vapor-volatile. It forms salt-like compounds with acids. Nicotinic acid (Pyridin-3-carbonic acid) results from oxidation.

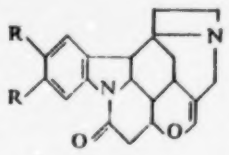
Nicotine quickly penetrates into the skin and mucosae. It is particularly dangerous when it gets into open wounds.

The lethal dose for rabbits (i. v.) is 6 mg/kg. Some animals, such as goats and does, are immune to nicotine. The lethal quantity for man is estimated at 50-100 mg. But 3-5 mg already will cause severe symptoms of poisoning such as breathing difficulty, severe cramps, and fainting spells lasting 3 days or more. Nicotine acts upon the CNS. Because it is soluble in water and fat, it can be used for poisoning essential and nonessential foods.

14.1.1.2. Strychnose Alkaloids

The Indian nux vomica (Strychnos nux vomica) and numerous other types of strychnos, in addition to other alkaloids, contain strychnine and bruzin (2-3 percent). Both alkaloids are of the indole type and are related to each other.

Bruzin represents the dimethoxy derivative of strychnine.



(1)

Strychnin R = H
Bruzin R = OCH_3

(14.2)

Key: 1--Strychnine.

Both alkaloids can be illustrated synthetically. Strychnine and bruzin are colorless, bitter-tasting crystals; the melting point: 268° C, bruzin 178° C. They are dissolved to a limited extent in water and in organic solvents. Strychnine nitrate and sulfate--both of which are colorless crystals--are dissolved better. Their solutions react neutral. They taste bitter.

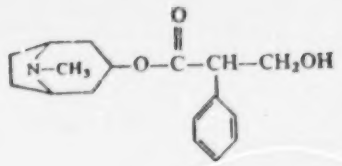
With alkalis, strychnine forms tryptamin under aggravated conditions. Strychnine takes on a blue-violet color due to the action of concentrated sulfuric acid and chromic acid.

Both alkaloids resemble tetanus toxin in terms of their toxic effect. Strychnine increases the sensory perceptions and the excitability of reflexes. Higher doses are followed by anxiety, trembling, speech disorders, painful stiffness of muscles, stiffness of the neck (the head is pulled to the rear), and distortions of facial features. The first "spasm" appears instantaneously as a result of external stimuli (noises, light). Exhaustion and the central paralysis of the respiratory center cause the lethal outcome of this poisoning. The cramps which come before death increase constantly. They are extremely painful and agonizing.

Doses starting at 15 mg can be lethal in adults and those starting at 5 mg can be lethal for children. Doses of 100-300 mg have an absolutely lethal effect. In doses of around 1 g, death occurs within 30 minutes due to paralysis of the respiratory center.

Because of its powerful toxicity, strychnine was a poison that was frequently used for purposes of assassination over a long period of time; it was used above all in pastry, sweet wine, wafers, and similar items. Bruzin is about between eight and forty times less poisonous than strychnine. Both of them are suitable for poisoning sweetened essential and nonessential foods.

14.1.1.3. Atropine



(14.3)

(1)
(±)-Hyoszyamin,
Tropansäuretropinester

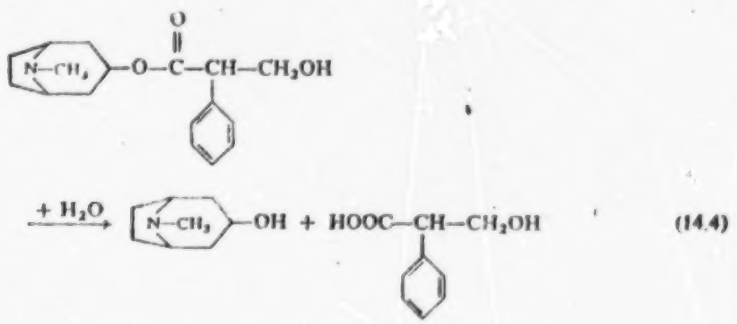
Key: 1--Tropanic [tropeinic] acid tropine ester.

Atropine occurs in belladonna (Atropa belladonna); optically active (-) hyoszyamin is furthermore found in other solanaceae (henbane, scopolia type, mandrake). Atropine and (-) hyoszyamin are isomeric and differ from each other only in that the latter, as acid component, contains optically active tropanic [tropeinic] acid. The main affect of atropine is credited to the content of (-) hyoszyamine. Atropine can be illustrated synthetically.

Atropine forms colorless, needle-shaped crystals which are dissolved in water to a limited degree. It has a repugnantly bitter, tart taste. It is soluble in organic solvents (alcohol, ether, chloroform) and in fatty oils.

While crystalline atropine sulfate is dissolved rather well in water and alcohol but not in ether and chloroform; melting point: Atropine, 115° C, (-) hyoszyamin 168.5° C, atropine sulfate 183° C.

Aqueous atropine solutions react slightly alkaline. Upon heating, hydrolysis takes place into tropine and tropanic [tropeinic] acid. Atropine is oxidizable.



(14.4)

In small doses, atropine or hyoszyamin excit the CNS while larger doses paralyze it. Taken orally, it is quickly resorbed in the gastrointestinal tract.

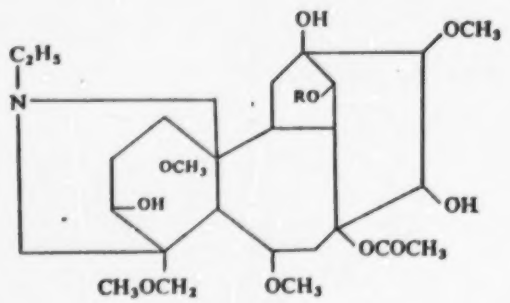
The subcutaneous dose for man is around 15 mg/kg of body weight. Depending on the doses administered, the following symptoms appear according to Hausschild:

0.5 mg: Dryness of skin, slowdown in heart rate;
0.5-1 mg: Dryness in mouth, thirst;
1-2 mg: Widening of pupils, heart acceleration;
3-5 mg: Restlessness, muscular weakness, trouble swallowing, headaches;
7 mg: Maximum widening of pupils, lack of muscle coordination;
More than 10 mg: Apathy hallucinations, states of delirium, unconsciousness;
More than 100 mg: Respiratory paralysis.

Hot, scarlet skin, temperature rise, trembling of limbs and constant movement of limbs are characteristic of atropine poisoning. The effect on the CNS is expressed through a compulsion to talk, dancing, fits of laughing, raving, and mania. Atropine acts as psychotomimetic.

Atropine is used therapeutically as antidote to suppress the effect of muscarine and nicotine due to the accumulation of acetylcholine following contamination with phosphororganic compounds and is a component of medical aid pouches.

14.1.1.4. Aconitine



R:C_6H_5CO—

(14.5)

Aconitine occurs in various types of aconitum, for example, in genuine blue monkshood. It is one of the most powerful plant toxins.

The colorless, board-shaped, ordorless crystals (F 197-198° C) are almost insoluble in water but they are soluble in organic solvents (alcohol, ether). The acqueous solution reacts alkaline. The salts are better soluble in water.

Aconitine is decomposed in water, by means of alkalis and acids, especially in case of heating. Acetyl and benzoyl groups are separated due to alkali liquors and we get aconine.

Initially, aconitine excites the respiration which however later on under certain circumstances can slow down all the way to respiratory stop. After the poison's resorption, the entire body is seized with a crawling sensation (as if ants were running); this is followed by chills and perspiration, a feeling of cold, paralysis of skeletal musculature (tongue, face), vomiting, a sensation of retching, and an increase in motor unrest. The poisoning victim

will rear up and then throw himself down again. Consciousness is preserved until death (heart stoppage, respiratory paralysis).

Death can take place within an hour.

The oral dose lethal for man is reported to be about 2-5 mg. For horses, we have an LD_{50} of 0.004 mg/kg, for rats we have 0.11 mg/kg in case of i.v. administration.

The German fascist SS during World War II conducted cruel experiments with aconitine nitrate on inmates in the Buchenwald Concentration Camp. Marksmen would hit them in the thigh with projectiles that had been poisoned with this substance.

The first symptoms appeared after 20-25 minutes (motor unrest, slight flow of mucous). The flow of saliva increased after 40 minutes and became so heavy that the poison victims were no longer able to swallow it (retching, vomiting). Motor unrest increased tremendously (individuals rearing up, throwing themselves down, rolling the eyes). Unrest abated later (widening of pupils). These agonizingly murdered people died 121-129 minutes after they were hit by the projectile.

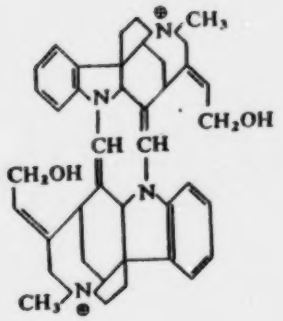
This example shows that such alkaloids and other poisonous substances can be used by means of poisoned projectiles. Aconitin and its related alkaloids (aconitines) can be used as sabotage poisons especially to contaminate essential and nonessential foods which do not have to be heated.

14.1.1.5. Curarine

Curarine has been known as an arrow poison since the 16th century. It is a brown, water-soluble, bitter mass which is obtained from the bark of liana [climbing] plant (Strychnos toxifera, St. Castelniaei) by means of aqueous extraction. We distinguish between tubocurarine and the more effect gourd curare. It contains the most poisonous plant alkaloids known so far.

The curare alkaloids are derivatives of indole. Gourd curare contains two alkaloid groups, one with about $C_{20}N_2$ and the other one with about $C_{40}N_{2-4}$, whereby the latter reveals the greater toxicity. Among them we have C-calebassin, C-curarine, and the toxiferines (C-toxiferine-I, C-Dihydrotoxiferine). The toxiferines or C-alkaloid E are the most poisonous curarine constituents.

C-toxiferine-I is believed to have the following makeup (Wieland, Pistor):



(14.6)

It is between five and ten times more poisonous than aconitine. Unpurified gourd curarine is about ten times less poisonous. The lethal dose of tubocurarine chloride for man is between 0.25 and 0.4 mg/kg of body weight. It is between 10 and a 100 times less poisonous than toxiferine or C-alkaloid E.

Curarine is not reduced in the gastrointestinal tract and is resorbed only slowly. It remains unaltered in the urine. Oral doses of curarine therefore are much less effective than in other types of application. If it is not contained in excessively large quantities, meat or other essential foods poisoned with curare can be consumed. Curare, which has gotten into the organism via other routes or through flesh wounds, will lead to the depolarization of the receptors of the motor end plates and to paralysis. It is reversible. Curarine paralysis starts with the face musculature (initially, the outer eye muscles, followed by the throat and neck muscles). Next, the musculature in the abdomen, the extremities, and finally in the respiratory center are paralyzed. Subjectively, contamination results in double vision, trouble swallowing, lowering of the head, respiratory difficulties, and others. In case of i.v. injections, the effect takes place after 2-3 minutes.

Curarine and its alkaloids are most effective when they get directly into the blood circulation through small wounds.

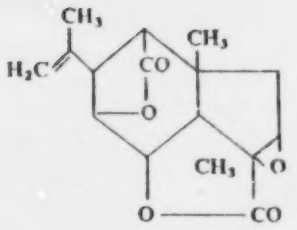
The curare alkaloids are not suitable for poisoning essential and nonessential foods. They can be used through prepared projectiles or the like.

Other highly toxic alkaloids for example are erytrophlein, homatropine, Kolchizin, Koniin, physostigmin, Veratrin, and anisatin.

Anisatin, $C_{15}H_{20}O_8$, is the active constituent of the seed of Illicium anisetum. The LD_{50} (i.p.) in mice is 0.7 mg/kg. Death is accompanied by spasms due to respiratory paralysis; 0.04 mg/kg will influence respiration and will cause spasms.

14.1.2. Picrotoxin

Picrotoxin is a constituent of the seeds (cocculus indicus) of a climbing plant (Anamirta cooculus [as published]) widespread in Asia. The toxin's most active component is picrotoxinin.



(14.7)

These are colorless, needle-shaped crystals with a bitter taste (F about 200° C) which dissolve little in cold water but which are dissolved better in boiling water. The toxin is soluble in alcohol but not in ether and chloroform. Its acqueous solutions react neutrally.

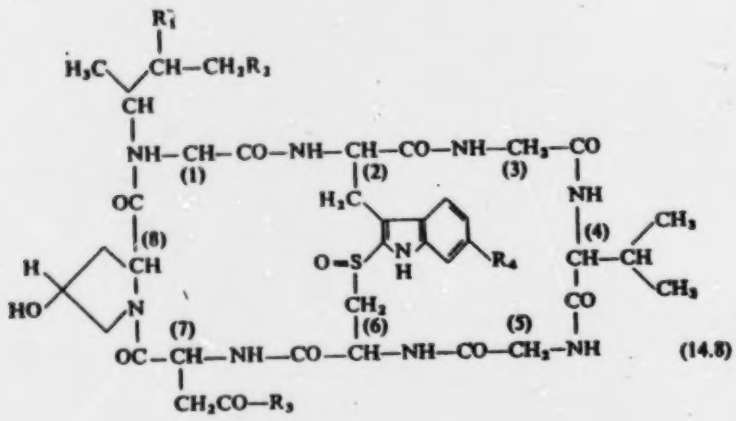
After oral consumption, one gets a burning sensation in the mouth. There is flow of saliva, followed by vomiting, and a feeling of thirst; the poisoning victim becomes dizzy, he experiences fear, is confused, and falls into a kind of somnolence. In addition there are delirium and cramps and the pupils are widened. The deadly poisoning terminates due to respiratory paralysis or exhaustion.

A protein-containing toxin is the active component of purple rose (the sea anemone Actinia equina). The chromatographically enriched product has an LD_{50} of 33.3 µg/kg of body weight in rats when administered i.v.

The toxin has a hemolytic effect. Lung edema and internal bleeding were observed in the poisoned animals. Death is due to respiratory paralysis.

14.1.3. Mushroom Toxins

The toxin sources of most poisonous mushrooms today are known in terms of their structure. The phallotoxins and amatoxins are the most poisonous along with the active substances of green Amanita phalloides and its white relatives (A. verna, A. virosa). These are cyclic polypeptides which contain acid-amide-like aminocarbonic acids and, as shown by the constitution of the amino toxins, are arranged around an indole nucleus.



(14.8)

They contain among other things (-)-alanin, (-)-threonin, (-)-cystein, (-)-tryptophane. (-)-oxyprolin and leucines.

The phallotoxins are more than ten times less poisonous than the most poisonous amatoxins. According to Wieland, the most poisonous amatoxins include the following:

		R_1	R_2	R_3	R_4	LD_{50} (1) (i.p., Mäuse) mg/kg
I	α-Amanitin	OH	OH	NH_2	OH	0,3
II	β-Amanitin	OH	OH	OH	OH	0,4
III	γ-Amanitin	OH	H	NH_2	OH	0,5
IV	ε-Amanitin	OH	H	OH	OH	
V	O-Methyl-α-amanitin	OH	OH	NH_2	OCH_3	0,2
VI	Desoxo-α-amanitin	wie (I), ohne O am S-Atom (2)			(OCH_3)	1,0

Key: 1--Mice; 2--Same as (I), without O on the S-atom.

V and VI are derivatives of natural toxins.

To obtain synthetically poisonous amatoxins, there is one prerequisite and that is that the eight amino acids of natural amanitin remain preserved as a ring which is divided between the amino acids (2) and (6) by means of a bridge, containing the indole ring, as sulfoxide or in the thioether structure. Amatoxins are synthetically demonstrable.

The phallatoxins, phalloidin and phalloin very quickly lead to serious liver damage while the liver and kidneys are attacked more slowly by the amatoxins.

Amanitin is a crystalline substance (F [melting point] 245° C). A quantity of 100 g fresh mushrooms will contain 10 mg phalloidin, 8 mg α-amanitin, and 5 mg β-amanitin.

The mushroom toxins are not decomposed in the intestine. They retain their activity after the mushrooms have been dried and boiled. In the organism they act as whole molecule or in molecule groups which are specially arranged in terms of space and structure.

Poisoning takes place after several hours of latency time and is expressed by vomiting, diarrhea, colic-like stomach cramps, accelerated breathing, and unconsciousness. Death occurs due to serious liver and kidney damage after 2-5 days.

The amatoxins can be compared to phosphorylated thiocholinesters in terms of their toxicity. Because they are hydrolytically and thermally stable, they are suitable as sabotage poisons above all to poison water, as well as essential and nonessential foods.

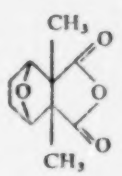
The active constituents of other poisonous mushrooms mostly involve alkaloids. The poison of fly amanita--muscarin—is an easily deliquescent crystalline mass (100 g of mushrooms will contain about 16 mg). Its LD_{50} (i.v., mice) is 0.23 mg/kg. It reacts alkaline in aqueous solutions.

It was possible from one of the Aspergillus species (watering can mold) to isolate a somewhat less poisonous metabolite, called Viriditoxin, as a crystalline green substance ($C_{34}H_{30}O_{22}$, F 242° C). It is reported to have an LD_{50} (i.p. mice) of 2.8 mg/kg.

14.2. Toxins of Animal Origin

14.2.1. Insect Poisons

Cantharidin (melting point 218° C) is the best-known and most effective insect poison.



(14.9)

It is a derivative of cyclohexane-dicarbonic acid and occurs in the so-called Spanish flies (Lytta vesicatoria). The crystalline compound, which is only poorly soluble in cold water, is synthetically demonstrable. It is dissolved rather well in fats and oils.

The lethal dose for man is around 40-80 mg. Oral ingestion is followed by saliva flow, a burning sensation, the formation of blisters and scabs in the mouth (serious damage to mucosae, severe thirst, nausea, bloody vomiting, bloody stool and urine (hemorrhage), severe pains in the kidneys, in the urinary duct and in the bladder, uterine bleeding, and enlargement of the sex organ (priapismus). The discontinuation of urine discharge leads to severe kidney damage. Death is accompanied by cramps in the bladder-kidney region.

Dissolved in oil, about 0.1 mg will cause big blisters on the skin's surface; there is painful necrotic destruction on the mucosae.

Cantharidin is known as a homicide poison. It could be used as sabotage poison in fat-containing essential foods.

14.2.2. Snake Poison

About 300-400 types of snake poisons are known. If we add the poisonous sea snakes, the number goes up considerably. Snake poisons do not have a uniform composition and consist of a mixture of biologically highly-active polypeptides and proteins which can contain small quantities of alkali salts, magnesium, and zinc. They contain large quantities of albumin-splitting and fat-splitting ferments. With a few exceptions, it has hardly been possible to this very day to isolate the ferments from snake toxins in pure form although it has been able to determine their existence. Mixtures of small-molecular, ferment-free polypeptides or peptides are blamed for the enormous toxic effect; here one cannot rule out the possibility that the enzymes start and promote the action mechanism of these peptides.

In some cases it has been possible to determine as many as 20 aminoacids in snake poison. Typically for all of them is a very high cysteine content (up to 5.5 percent in dry poison) which is blamed for the toxic effect.

Because of the big differences in their compositions, snake poisons do not cause any uniform contamination picture.

Slotta subdivides snake poisons into three groups according to their effect.

Poisons with Neurotoxic Effect

They have an effect resembling curare paralysis and this effect is expressed in a paralysis of the respiratory musculature, leading to death due to respiratory arrest.

A typical snake poison in this group is neurotoxin, a small-molecular, heavy basic polypeptide from the Indian cobra (Naja naja), also known as Indian cobra toxin.

In addition to the effect on the peripheral nerve endings, these poisons cause central disturbances which affect both the brain centers and the respiratory centers; the poison of the rattlesnake, crotoxin, which contains highly toxic crotactin, will cause blinding among other things.

Toxins Acting on Circulation

There will be a blood pressure drop after contamination here due to the release of biogenic substances acting upon the circulation. Cobra toxins and the poisons of the vipers also have an effect on the heart.

Poisons with Local Effect

In the case of these poisons it is typical that they act upon the blood and tissue cells, leading to necroses and bleeding which will then apear at the bite places or at the places of penetration into the skin.

Raw snake poisons are clear or milky-cloudy, colorless or golden-yellow liquids which, if left standing for a longer period of time, will coagulate and they are well soluble in water. Because of their high water content, they are lyphilated. The dry substance is powdery and can be kept for more than 20 years without any major decline in toxicity.

The neurotoxin from the cobra has a molecular mass of about 10,000 (6,000), while crotoxin has 12,000 (18,000). Neurotoxin contains 13 aminoacids while crotoxin contains 18. The empirical formula for crotoxin is $C_{1230}H_{1776}O_{432}N_{328}S_{36}$.

The lethal dose of the dry substance of the poison of the rattle snake has been estimated at about 24 mg while it has been estimated at about 70 mg in the case of viper poison for man. Death depends on the dose absorbed and in case of small doses comes within 8 hours, in case of larger doses, within an hour.

The poisons of marine snakes are considerably more poisonous than those of land snakes. The lethal doses determined on mice are about 10 times smaller in the case of marine snake poisons.

An LD_{50} of 0.11 mg/kg i.v. and 0.5 mg/kg s.c. was determined for mice in the case of crotoxin or its main fraction. In the case of the toxin of Naja naja, the fraction, which contains the neurotoxin, has an LD_{50} of 0.295 mg/kg for rats in case of s.c. administration. An LD_{50} of less than 0.05 mg/kg, i.v., has been given for the α-toxin of cobraoxin. This is a simple polypeptide molecule and contains 61 aminoacid remnants.

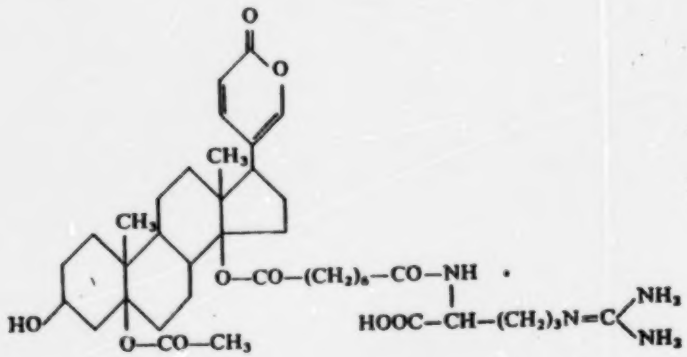
14.2.3. Scorpion Poisons

The toxins of tropical scorpions are particularly dangerous. The toxins are contained in the rear sting of the animal. They are easily resorped and they cause muscle cramps in the neck and chewing muscles, saliva flow, and lung edema after 2-3 hours. They are polypeptides. North American scorpion species above all contain neurotoxic components with molecular masses of around 15,000. In mice, the LD_{50} is 0.5 mg/kg. As much as 4 mg of dry substance can be obtained from one animal. About 200 guinea pigs can be killed with 0.5 mg of the poison from the North American thick-tail scorpion.

14.2.4. Frog Poisons

Various species of frogs secrete highly-poisonous toxins along with their skin secretions which have varying pharmacological-toxic effects. These are essentially toxins which have a very strong effect on the heart and those which have a neurotoxic effect. In recent years it has been possible by means of partial syntheses to make identical toxins. The poisons of frogs include batrachotoxin which is among the most poisonous substances of animal origin.

Bufotoxin and atelopidtoxin are strong heart poisons. In 1943, Behringer provided the following makeup for bufotoxin, one of the most active components of the common toad:



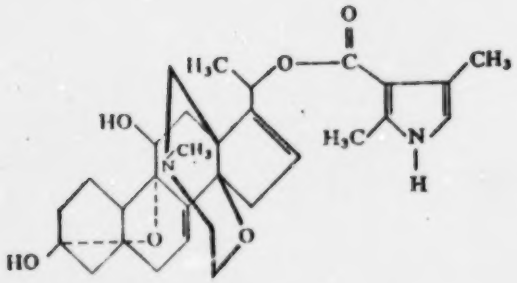
(14.10)

These are needle-shaped bitter-tasting crystals which melt at 204° C and are decomposed. The effectiveness of the toxin regarding the heart is comparable to that of the vegetable heart glycosides, strophantin or scillaren.

The body resorbes bufotoxin very quickly. Poisoning leads to an increase in blood pressure, an increase in the heart rate, an urge to vomit, and cramps. Death is due to ventricular fibrillation. The lethal dose for cats, i.v., is 0.3 mg/kg of body weight.

The poison from the skin of frogs of the Atelopus family is more effective. A concentrate of the dialyzable atelopid toxin, which proved to be a strong heart poison, had an average lethal dose, i.v., of 0.016 mg/kg of body weight for mice.

Neurotoxic and cardiotox batrachotoxin:



(14.11)

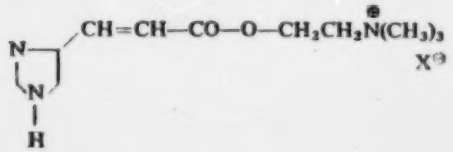
is the active substance of kokoi poison which is contained in the skin secretion of the Colombian arrow-poison frog (Phyllobaties aurotaenia). In addition to batrachotoxin the poison contains isobatrachotoxin and a batrachotoxin A. The kokoi poison is a base which is soluble in halogenated alkanes and chloroform.

Batrachotoxin is a steroid alkaloid. It blocks the motor end plates. Death is accompanied by severe spasms and is due to respiratory paralysis. The average effective dose is reported to be below 0.5 µg/kg. The lethal dose for man, that is, LD_{50}, has been estimated at 2 µg/kg. In mice, the LD_{50} is 1.15-2.7 µg/kg; for batrachotoxin A it is given at 0.1-0.3 µg/kg.

14.2.5. Poisons from Marine Animals

The most poisonous toxins from marine organisms--tetrodotoxin and saxitoxin--are listed in the pertinent literature as potential toxin warfare agents. In recent years moreover a large number of toxic substances from various marine animals has been investigated and partly identified; these may be of military interest because of their toxicity. Depending upon their type, marine organisms produce toxins with widely differing composition, such as cholinesters, polypeptides, proteins, heterocyclic systems with a complicated structure, but also amins with a simple structure.

14.2.5.1. Murexin



(14.12)

Chemical name: Imidazolyl-4-propane-acid-cholinester.

Murexin is an imidazol derivative and is isolated from purple snails (Muricidae). It can be made synthetically.

Its pharmacological effect resembles that of other choline derivatives. Murexin excites the ganglia and blocks nerval stimulus transmission. As a result of the polarization of the motor end plates, the effects are equal to those of the disturbance of ACh metabolism through ChE inhibition. Murexin is not hydrolyzed by ChE.

Murexin poisoning will lead to the paralysis of the skeletal musculature. The deadly outcome of contamination is the result of paralysis of respiratory musculature.

14.2.5.2. Seneziolylcholine

$$(CH_3)_2C{=}CH{-}CO{-}O{-}CH_2CH_2\overset{\oplus}{N}(CH_3)_3\ X^{\ominus} \qquad (14.13)$$

Chemical name: 3-Methylbutene-(2)-acid cholinester; β, β-dimethylacrylic acid cholinester.

Seneziolylcholine is isolated from the gastropods Thais floridiana. In them it is probably formed from valin and choline according to the following:

$$(CH_3)_2CH{-}\underset{\displaystyle NH_2}{\underset{|}{CH}}{-}COOH \xrightarrow[-\,NH_3]{} (CH_3)_2C{=}CH{-}COOH$$

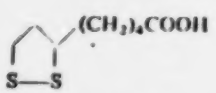
$$\xrightarrow{\text{Choline}} (CH_3)_2C{=}CH{-}CO{-}O{-}CH_2CH_2\overset{\oplus}{N}(CH_3)_3 \qquad (14.14)$$

In alkaline solutions, seneziolylcholine is decomposed along with the formation of water-vapor-volatile acrylic acid.

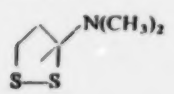
The toxic principle corresponds to that of murezin. The toxin does not split ChE or it does so only to an insignificant extent.

14.2.5.3. Nereis Toxin

Nereis toxin is a compound related to liponic acid, 6,8-thiooctane acid (14.15) in which a dithioether is connected in ring-shape with a dimethylamino group and which has the following structure (14.16):



(14.15)



(14.16)

This is a very strong neurotoxin which occurs in the marine ringworm Lumbriconeris heteropada. Poisoning leads to a narrowing of the pupils, to the flow of saliva and tears, as well as to muscle contractions. The lethal dose, s.c., for rabbits is 1.8 mg/kg. Compared to other toxins, it is relatively high.

14.2.5.4. Additional Toxins from Marine Animals

Anglerfish toxin is secreted by Trachinus draco from the glands in the skin. Necrotic skin damage will result already from contact with the fish due to the pricks of the stings on the backfin. The organism very easily resorbs the poison. The general toxic effect is expressed by difficulty in breathing, a feeling of dizziness, profuse sweating, delirium, and cramps. Such contact poisoning very rarely leads to death. Undiluted, 100 percent $4 \cdot 10^{-4}$ cm^3 of toxin will kill mice within 24 hours. As -60° C, the toxin can be stored for at least 2 years with glycerin additions. The poison is destroyed by alcohol, acids, and lyes.

Maculotoxin is a neurotoxin resembling tetrodotoxin and saxitoxin which is separated from the rear saliva glands of the squid Hapalochlaena maculosa. Respiratory paralysis and bradycardia were observed in rats after poisoning.

Sea Snake Toxins

Some species of sea snakes are more poisonous than land snakes. The Laticanda (L. laticandata, L. colubrina, L. semifasciata) species contain very strong toxins. The poison from the last-mentioned species contains three toxins, that is, erabutoxin a, B, and C. All three toxins contain 62 aminoacid remnants and four dithioether bridges. The toxins are crystalline, their molecular weights are around 7,000. Erabutoxin C has an LD_{50} 0.13 µg/kg of body weight for mice. These toxins work in a manner similar to acetylcholine.

Palytoxin was isolated from a coelenterate (Palythoa) from the Zoanthidae family. It is a noncrystalline, white, very hygroscopic substance with a sum formula of $C_{41}H_{73}NO_{20}$. It is included among the most poisonous natural toxins. The chromatographically isolated toxin had an LD_{50}, i.v., of 0.15 µg/kg and, i.p., of 0.4 µg/kg for mice.

15. Synthetic Poisons

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15. Synthetic Poisons

In discussing natural poisons we were already able several times to point out that many of them are synthetically demonstrable and that a large number of their synthetic analogs are highly poisonous compounds. Basically, a separation would not be justified if one were to deny the origin of these compounds and especially the start of research in these fields. Investigations on toxins thus start with microbiology and with experiments designed to make them synthetically and then switch to chemistry. This accordingly applies to all other natural substances. The manufacture of synthetic poisons, and the manufacture of most chemical warfare agents, from the very beginning were connected with chemistry and chemical toxicology. Only later was it found that one or the other compound was an effective constituent of a naturally occurring toxin. This also applies to the fluorocarbonic compounds described here, more specifically, sodium- and potassium fluoroacetate, which are the toxic principle of Dicephalatum cymosum, a plant well known from South Africa. We also know that hydrocyanic acid, produced in industry on a large scale, occurs in about 300-400 different plants.

In this chapter we will therefore cover those compounds or groups of compounds which are synthetic compounds from this viewpoint. They are powerful poisons and as such they are suitable for military uses in poisoning men and useful animals, either in the form of sabotage poisons or, under certain circumstances, also as warfare agents in combat. The latter of course applies only to the organic compounds. Hardly any of the inorganic compounds mentioned has properties that would make it suitable as warfare agent in combat although experiments were also conducted along these lines.

15.1. Fluorocarbonic Compounds

The fluorocarbonic compounds were tested in several countries at the start of World War II for their suitability as CW agents. The first organic fluorine compounds had been made already before the turn of the century. Systematic work in this field of fluorine chemistry began about 50 years ago. There was a big upswing here after World War II. Fluorine chemistry is now used in plastics chemistry; its products are used in dyeing and textile aids, as fire-fighting and coolant substances, in metallurgy, as pest control agents, etc.

The high toxicity of certain organic fluorine compounds persuaded military chemical research in the imperialist countries to make such compounds and to test them for their usefulness as warfare agents. This was done above all in fascist Germany and in Great Britain and during World War II. As the choice was narrowed down, the chemists settled among others on hydrofluoric acetic acid methylester (15.1) and 2-fluorethanol (15.2).

$$FCH_2COOCH_3 \qquad (15.1)$$

$$FCH_2CH_2OH \qquad (15.2)$$

The compounds selected in an almost idea fashion meet the ideal requirements for sabotage poisons. They are stable and they are imperceptible; their mixability with water is partly good. They are highly toxic and they ta' effect only later because of the latency time. Both the analytical and their histological recognition is difficult, as is the treatment of contamination. This is why the investigations were directed at the possible use of these compounds as sabotage poisons to contaminate drinking water, food and fodder, pasture land and the like, which is what these compounds are suitable for.

15.1. Structure and Effect

Organic fluorine compounds are toxic or nontoxic. The prerequisite for toxic activity is their behavior during hydrolysis or during oxidation. They are toxic if the organic fluorine compound is in a position, in case of biochemical reactions, to form hydrofluoric acetic acid, FCH_2COOH, or their ion. That can be acids, amides, acid halogenides, esters, alcohols, aldehydes, ether, and others. Saunders et al. found that they are very toxic only when we are dealing with compounds with the basic structure:

$$F(CH_2)_nCOX \qquad (15.3)$$

where n is an uneven number (sec Table 15.1).

This observation applies to almost all organic fluorine compounds if they incline toward the formation of the radical FCH_2CO-. Any substitution on the α carbon atom of this radical leads to a reduction of elimination of toxic activity even if we are dealing with a second or third fluorine atom.

The striking change in toxicity within a homologous series is compared to Knopp's theory of β oxidation of fatty acids in the organism where the ω fatty acids are gradually reduced to acetic acid.

$$\begin{array}{l} RCH_2CH_2COOH \xrightarrow[-H_2]{} RCH{=}CHCOOH \\ \xrightarrow[-H_2]{+HOH} RCOCH_2COOH \xrightarrow{+HOH} RCOOH + CH_3COOH \end{array} \qquad (15.4)$$

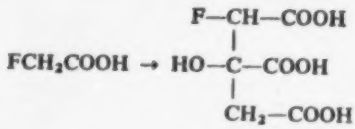
Organic fluorine compounds are reduced parallel to this β-oxidation.

$$\begin{array}{l} FCH_2CH_2CH_2COCH_2COOH \rightarrow FCH_2CH_2CH_2COOH + CH_3COOH \\ FCH_2CH_2CH_2COOH \rightarrow FCH_2COOH + CH_3COOH \end{array} \qquad (15.5)$$

Toxic hydrofluoric acetic acid is formed only in compounds where n is an uneven number. Compounds where n is an even number and those with branches [ramifications] are not reduced to hydrofluoric acetic acid. They are nontoxic, like 4-Fluor-2,2-dimethylbutane acid, $FCH_2CH_2C(CH_3)2$.

Because some organic fluorine compounds do not follow the rule of β-oxidation, other action principles are discussed.

It is now accepted as certain that the toxic principle of organic fluorine compounds is the conversion of hydrofluoric acetic acid into hydrofluoric citric acid.



(15.6)

This leads to the blocking of the tricarbonic acid cycle. According to Peters (Proc. Roy. Soc. London, Ser. B. 139 (1951/52), p 943), there is an assumption that we have a competitive inhibition of the enzyme aconitase here which participates in the conversion of citric acid into iso-cetric acid. Due to this blocking, the energy supply is interrupted and normal cell function is impaired.

The enrichment of citric acid furthermore causes the binding of calcium ions and this triggers nerval and muscular disorders.

Carbon fluoride compounds can have an effect after inhalation after ingestion into the gastrointestinal tract, and, in the case of some of them, also after percutaneous resorption. Latency periods of 0.5-6 hours are followed by motor unrest, vomiting, saliva flow, and epilepsy-like spasms which are repeated periodically.

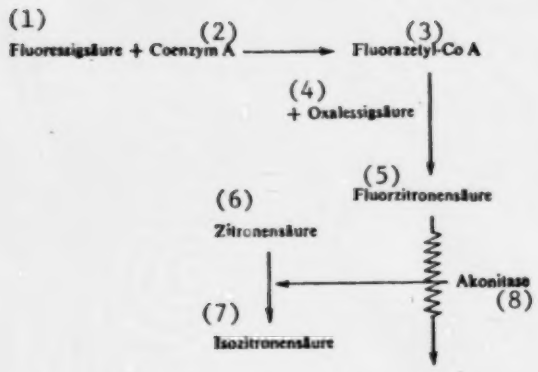


Figure 15.1. Inhibition of citric acid cycle by hydrofluoric acetic acid. Key: 1--Hydrofluoric acetic acid; 2--Coenzyme A; 3--Fluoracetyl-Co A; 4--Oxalacetic acid; 5--Hydrofluoric citric acid; 6--Citric acid; 7--Isocitric acid; 8--Aconitase.

Additional symptoms are involuntary defecation and urination, possible loss of speech, and deep unconsciousness; voluminous secretion of fluids from the bronchial glands cause breathing difficulty. Death is due to cardiac arrest depending upon the concentration of dose after 3 hours or within 4-5 days; 75 percent of the poisoning cases end in death.

The toxicity of the compounds to be considered is roughly the same. Regardless of the type of compounds, the lethal dose for man is 2-10 mg/kg body weight.

The ω-hydrofluoric carbonic acid, their esters, and the ω-hydrofluoric alcohols are of special interest.

15.1.2. ω-Hydrofluoric Carbonic Acids

$$F(CH_2)_nCOOH \qquad (15.7)$$

As we can see in Table 15.1 hydrofluoric acetic acid is the most toxic hydrofluoric carbonic acid. It is the toxically-active basic compound of hydrofluoric carbonic acid derivatives. It is colorless compound which forms needle-shaped crystals, which melt at 30° C, and which boils at about 167° C. Hydrofluoric acetic acid is easily dissolved in water and alcohol.

Its salt, sodium fluoroacetate (NFA) FCH_2COONa, a crystalline substance (melting point 76° C), is better suited as sabotage poison. It is soluble in water it is soluble only to a limited degree in alcohol.

Table 15.1. $F(CH_2)_nCOOH$

n	Kp	F	LD_{50} (2) (Mäuse, i.p.)
	°C (Torr)(1)	°C	mg/kg
1	167 ... 168 (760)	31 ... 32	6,6
3	60 ... 62 (2)		0,65
5	193 (762)		1,35
7	145 ... 148 (10)		0,64
9		49	1,5
11		60 ... 61	1,25
17		69	5,7
2			60
4			100
6			40
8			100
10			58

Key: 1--mm Hg; 2--Mice.

The analogous potassium compound was isolated from the previously mentioned African plant called Gifblaar (poison leaf). According to local experience, a few leaves of the plant are sufficient to kill sheep, goats, and cattle. Another plant, D. taxicarium, likewise at home in these regions, in its fruit contains ω-fluoro-oleic acid and ω-fluoroal-palmitin acid. The powdered seed is used as "ratsbane" rat poison. The plants were used by the local inhabitants at the time of colonial rule to poison wells, springs, and creeks and to make poison for arrowheads.

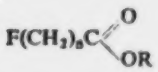
When taken orally, sodium fluoroacetate has a lethal effect on sheep at a rate of 0.7 mg/kg, for horses at 1.0 mg/kg, and for man at 2-10 mg/kg. In sheep, smaller doses did not produce any recognizable symptoms; only additional identical doses had a toxic effect.

Just a few drops of hydrofluoric acetic acid in a bucket of water will kill horses. Dogs, which ate the meat of poisoned horses, died likewise.

Free hydrofluoric acetic acid is made by means of hydrolysis of the hydrofluoric acetic acid ethylester in slightly alkaline medium according to the following:

$$FCH_2COOC_2H_5 \xrightarrow{+\ HOH} FCH_2COOH + C_2H_5OH \qquad (15.8)$$

15.1.3. ω-Hydrofluoric Carbonic Acid Alkylester



(15.9)

In the case of the hydrofluoric carbonic acid alkylesters it was also confirmed that those where n is an uneven number are toxic (see Table 15.2). The hydrofluoric acetic acid alkylesters, FCH_2COOR, and hydrofluoric acetic acid-2-fluoroethylester are of interest for military chemistry. The latter belongs to a group of compounds which, compared to the nonsubstituted alkylesters, revealed higher toxicity. These hydrofluoric carbonic acid 2-fluoroethylesters were made during World War II with the intention of combining the toxic properties of the ω-fluoroalkanoles with those of ω-hydrofluoric carbonic acid alkylesters.

Among the hydrofluoric acetic acid alkylesters, hydrofluoric acetic acid methylester was included among the smaller number of substances considered as potential warfare agents during World War II.

Hydrofluoric acetic acid methylester (methylfluoroacetate, MFA) is a colorless and ordorless liquid which is dissolved in organic solvents, such as alcohol, petrolether and ether. Its solubility in water is 15 percent. The ester can be mixed in any ratio with sulfur Yperite and other warfare agents. It becomes rigid at about -32° C. Its vapor pressure at 20° C is 15 mm Hg; at the same temperature, the saturation concentration is 92 $mg \cdot l^{-1}$ ρ at 20° C 1.1744 $g \cdot cm^{-3}$.

The compound is chemically very stable. In an aqueous solution it is slowly hydrolyzed into identically toxic hydrofluoric acetic acid.

$$FCH_2COOCH_3 + H_2O \rightarrow FCH_2COOH + CH_3OH \qquad (15.10)$$

Table 15.2 $F(CH_2)_nCOOR$

n	R	Kp °C (Torr) (2)	LD_{50} (3) Mäuse, s.c.[1]) mg/kg
1	CH_3	105,5 (760)	15
3	CH_3	78,5 (100)	(0,7)
5	CH_3	70 ... 71 (1)	(1,6)
1	C_2H_5	117 ... 118 (760)	15
2	C_2H_5		200
4	C_2H_5	56 ... 60 (16)	160
5	C_2H_5	82 ... 84/14	4
7	C_2H_5	145 ... 150/12	9 (1,75)
9	C_2H_5	135 ... 138/10	10 (1,65)
10	C_2H_5	140 ... 141/11	100
11	C_2H_5	152 ... 153/11	20
1	FCH_2CH_2	158 (760)	8,5
5	FCH_2CH_2	103 ... 105 (14)	2,5
7	FCH_2CH_2	128 ... 130 (13)	7
9	FCH_2CH_2	145 ... 149 (12)	10

[1]) In Klammern: Mäuse, i.p.

Key: (1) In parentheses: mice, i.p.; 2--mm Hg; 3--Mice.

A 15-percent aqueous solution at 23° C after 60 hours will only separate 2.5 percent of the total fluorine quantity and about 50 percent after 14 days. The cause of the slow hydrolysis speed can also be explained in terms of the heavily polar character of the C-F bond which counteracts a separation of the C-O bond.

Alkalis promote hydrolysis. In a 20-percent alcoholic alkalihydroxide solution, it is possible to hydrolyze 50 percent after boiling 20 hours.

Acids do not promote ester hydrolysis so that neither the latter nor the alkali lyes would be suitable decontamination agents.

Energetic reactions develop with aqueous, alcoholic, or etheric ammonia solutions. The following is reproduced:

$$FCH_2COOCH_3 + NH_3 \rightarrow FCH_2C\begin{matrix}O\\ \diagdown\\ NH_2\end{matrix} + CH_3OH \qquad (15.11)$$

Fluoroacetamide which is likewise toxic, just like MFA. These are colorless crystals which melt at 108° C and which are soluble in water to the extent of about 15 percent.

In a similar manner primary amins form corresponding toxic N-alkylacetamides. α-fluoro-N-methylacetamide, which is contained in methylamide according to

$$FCH_2COOCH_3 + CH_3NH_2 \rightarrow FCH_2C\langle \overset{O}{\underset{NHCH_3}{}} + CH_3OH \qquad (15.12)$$

is a crystalline compound (melting point 64° C).

The ester is split by strong oxidation agents. In this way we get carbon dioxide and hydrogen fluoride with chromosulfuric acid.

$$FCH_2COOCH_3 + 6[O] \rightarrow HF + 3CO_2 + 2H_2O \qquad (15.13)$$

Potassium permanganate and nitrohydrochloric acid also have an oxidizing effect. Hypochlorite solutions do not react with MFA. Reactions materialize only with highly-active chlorine-containing compounds.

The LD_{50} for rabbits is 0.25 mg/kg, i.v. The toxic effects starts in animals after 30-60 minutes. The experiments conducted by Saunders on himself did not cause any poisoning at concentrations of $1:10^6$. The dangerous concentrations are above $1:10^5$.

Fluoroaceticacidmethylester among other things can be made by means of reactions of chloroacetic acid methylester with potassium fluoride.

$$ClCH_2COOCH_3 + KF \rightarrow FCH_2COOCH_3 + KCl \qquad (15.14)$$

The higher ω-fluorocarbonicacid alkylesters are likewise colorless liquids which behave in a manner similar to MFA in chemical terms. As the C number increases, their water solubility and reactivity decline.

Fluoroaceticacid-2-fluoroethylester, $FCH_2COOCH_2CH_2F$, is a colorless, slightly odorous liquid (ρ at 20° C, 1.29 g cm^{-3}) which becomes rigid at -25.4° C. It and its homologous compounds are extremely stable, they do not hydrolyze, and they react only with strong oxidation agents, for example, chromosulfuric acid. They form condensation products with alkalialcoholates.

The most toxic among the fluoroethylesters is ω-fluoropenta-carbonicacid-2-fluoroethylester. The higher toxicity of fluorocarbonicacid-2-fluoroethylester

compared to the nonsubstituted esters and also compared to fluoroethanol, is traced back to the two active fluorine groups in the molecule and not only to hydrolytic decomposition in tne organism according to the following:

$$FCH_2COOCH_2CH_2F + H_2O \rightarrow FCH_2CH_2OH + FCH_2COOH \qquad (15.15)$$

15.1.4. ω-Fluoroalkanols

$$F(CH_2)_nCH_2OH \qquad (15.6)$$

The ω-fluoroalkanols are roughly just as toxic as the previously mentioned fluorocarbonicacids and their esters (see Table 15.3). The lower fluoroalkanols are colorless liquids which are soluble in water. They are dissolved in organic solvents but not in petrolether.

Table 15.3. $F(CH_2)_nCH_2OH$

n	Kp	(2) LD_{50} (Maus, i.p.)
	°C (Torr) (1)	mg·kg
2	102 ... 104 (760)	10
3	126 ... 128 (700)	46,5
4	52 ... 53 (11)	0,9
6	85 ... 86 (14)	1,24
8	106 ... 107 (10)	0,6
10	136 ... 137 (15)	1,0

Key: 1--mm Hg; 2--Mice.

2-fluorethanol (FEA), FCH_2CH_2OH, can be mixed with water in any ratio. It becomes rigid at -43° C; ρ at 20° C is 1.104 $g \cdot cm^{-3}$.

It is stable in water, its acedic properties are more pronounced than in the case of ethanol. It is difficult to oxidize; only 6 percent fluorethanol are reproduced at 100° C with manganese (IV)-oxide and sulfuric acid:

$$FCH_2CH_2OH \xrightarrow[-HOH]{+[O]} FCH_2CHO \qquad (15.17)$$

Fluoroaceticacid develops with potassium permanganate; the yield is small.

The reaction with surplus sulfurylchloride at 60° C gives us the likewise toxic chlorosulfonicacid-2-fluoroethylester which irritates the upper respiratory passages.

$$FCH_2CH_2OH + SO_2Cl_2 \rightarrow FCH_2CH_2OSO_2Cl + HCl \qquad (15.18)$$

In case of excess fluoroethanol, we get the less toxic and nonodorous Bis-(2-fluoroethyl)-sulfuric acid ester.

$$2\,FCH_2CH_2OH + SO_2Cl_2 \rightarrow (FCH_2CH_2O)_2SO_2 + 2\,HCl \qquad (15.19)$$

Phosgene and fluoroethanol at 0° C produce the highly irritating chlorocarbonic-acid-2-fluoroethylester.

$$FCH_2CH_2OH + COCl_2 \rightarrow \begin{matrix} Cl \\ \diagup \\ CO \\ \diagdown \\ OCH_2CH_2F \end{matrix} + HCl \qquad (15.20)$$

In the presence of pyridin, fluoroethanol reacts with phosphorus (III)-chloride to form Tris-(2-fluoroethyl)-phosphite, $P(OCH_2CH_2F)_3$, a compound which is supposed to have a depressing effect on the CNS.

According to Saunders, after an exposure time of 10 minutes, 62 percent of the experimental animals (rabbits, rats, guinea pigs) are killed by a concentration of 0.29 $mg \cdot l^{-1}$ while 38 percent are killed by 0.14 $mg \cdot l^{-1}$. For the same exposure time, the LC_{50} [as published] at MFA is 0.1 $mg \cdot l^{-1}$ and for the fluoroaceticacid-2-fluoroethylester it is 0.05 $mg \cdot l^{-1}$. Contamination ended in death within 12 hours.

According to Dukelskaya, the time of death, as investigated on white rats, will depend on the dose (see Table 15.4).

Table 15.4.

Anzahl der Tiere (1)	Dosis (mg/Tier) (2) (3)	Anzahl der toten Tiere (4) nach (5) 2	4	6	12	18	24	48	72	96h (6)	überlebende Tiere (7)
25	0,08	–	2	5	1	2	6	2	1	1	5
30	0,1	1	2	16	14	5	8	–	–	–	–
20	0,5	2	6	–	4	–	7	–	–	–	–
10	1,0	1	1	1	3	3	1	–	–	–	–
5	2,0	1	–	3	1	–	–	–	–	–	–
15	5,0	2	–	10	–	1	2	–	–	–	–
5	10,0	–	4	1	–	–	–	–	–	–	–

Key: 1--Number of animals; 2--Dose; 3--Animals; 4--Number of dead animals; 5--After; 6--Hours; 7--Surviving animals.

Fluoroethanol among other things can be made by means of the condensation of hydrogen fluoride with ethyleneoxide in ethylether at 100° C or in the presence of catalytically acting traces of water according to the following:

$$\underset{\diagdown\mathrm{O}\diagup}{\mathrm{CH_2{-}CH_2}} + \mathrm{HF} \rightarrow \mathrm{FCH_2CH_2OH} \qquad (15.21)$$

15.2. Carbamates

$$\mathrm{CH_3NHCOO{-}R} \qquad (15.22)$$

Carbamates are mentioned several times in the literature as potential warfare agents (Sipri and others). These are the kind which have a relatively high toxicity against warm-blooded creatures. The oldest toxic compound in this group is Eserin (Physostigmin, 15.23), a natural poison whose structure has been known since 1925 and which was recognized as toxically active in the n-methylcarbamate group of $NC{-}CH_3{-}{-}COO{-}$.

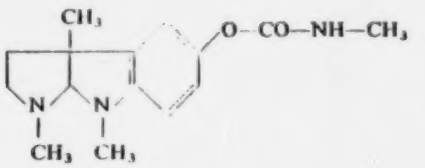
Carbamates inhibit cholinesterase and therefore are comparable to phosphororganyls in terms of their effect.

By means of carbamylation of the enzyme by deposit on its esteratic and anionic place it leads to endogenous acetylcholine poisoning due to blockage.

The dimethylcarbamates are colorless liquids or partly also solid substances which are little dissolved in water and gasoline but which are [illegible passage in photostat] easily dissolved in organic solvents such as alcohols, ketones, and ether. Without exception, the monomethylcarbamates of phenol and oxides are colorless crystals with a characteristic melting temperature. They are among the most toxic specimens.

By way of example we might mention the following:

3,5-dimethyl-4-dimethylamino-phenylmethylcarbamate (15.24); LD_{50} p.o. 15-63 mg/kg for warm-blooded creatures, in case of repeated contact, it acts through the skin; 3-(N,N-dimethyl-methylene-imino)-phenyl-methylcarbamate (15.25), LD_{50} p.o. 20 mg/kg in the case of rats; 2-methyl-2-(methylthio)-O-(methyl-carbamoyl)-propionaldoxim (15.26), LD_{50} p.o. 0.93 mg/kg for rats, 5 mg/kg for rabbits on the skin.



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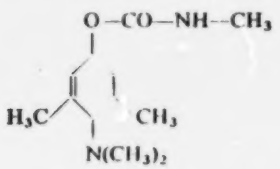

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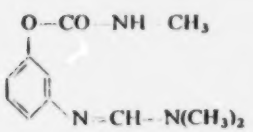

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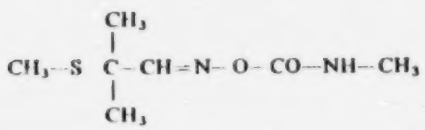
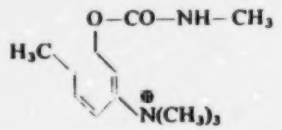


(15.26)

The last-mentioned compound can be used as insecticide only to a limited extent because of its excessively high toxicity for warm-blooded creatures. For this purpose it is granulated and covered with a water-soluble plastic layer to prevent contamination through the skin. It has a systemic effect and is oxidized into sulfoxide in the plant whose ChE-inhibiting effect is 10 to 20 times stronger.

The highest toxicity is encountered in carbamates which contain quaternary alkylammonium groups because they have functionally more favorable prerequisites when it comes to establishing reciprocal interaction with the anionic place on the ChE surface, something which is similarly the case with the quaternary phosphorylcholine derivatives, for example, the V-substances [annihilation agents]. The following among others are listed as potential warfare agents: 2-methyl-5-(trimethylammonium)-phenylmethylcarbamate (15.27); 5,N,N-dimethylcarbamoyl-1-methylquinolinium-bromide (15.28) and 1-(3'-trimethylammoniumphenoxy)-3-(3'-trimethylammoniumphenoxy-5'-N,N-dimethylcarbamoyl)-propane-di-iodide (15.29)



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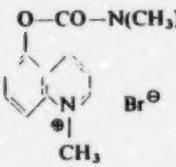

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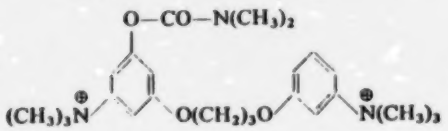
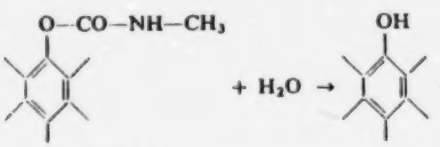


(15.29)

The carbamates are thermally stable up to 100° C but they are decomposed above 100° C, especially so in the presence of metal salts. With respect to alkalis they are unstable and in this respect they can be compared to Sarin. During alkaline hydrolysis, we get methyl- or dimethylamin, CO_2 and the pertinent phenol or oxim according to the following:



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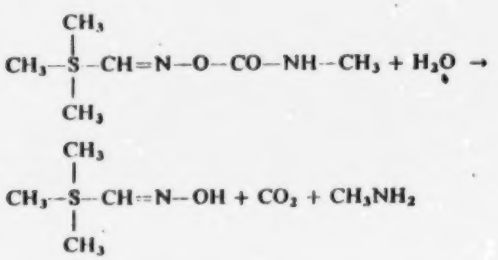
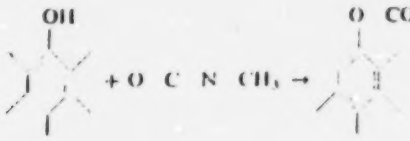


(15.31)

In neutral aqueous emulsions and suspensions they are sufficiently stable.

They can be made from the corresponding phenols by means of reaction with methylisocyanate according to the following:



(15.32)

in the presence of trimethylamin.

The pertinent literature contains corresponding references to the possible military uses of carbamates as warfare agents in combat. But they must be considered also as sabotage poisons.

15.3. Inorganic Toxins

Almost all inorganic compounds, so to speak, have certain physiological and pharmacological properties or they are partly highly toxic. That depends on the quantity, on the number of doses consumed, and, last but not least, on the manner in which the substance is introduced into the body. The toxic properties of inorganic compounds mostly are not as strongly pronounced as in the case of the organic ones. The number of toxins among the inorganic substances is much less than in the case of the organic ones. Compounds possible for sabotage purposes--to the extent that they are sufficiently soluble in water--are used in poisoning certain foods and drinking water.

Less soluble compounds for example can be used to poison flour, sugar, and salt. Arsenic III-oxide is suitable for poisoning flour used in making bread, while various mercury (II)- and lead salts are used to poison sugar, table salt, and other items.

Poisons to be used for contaminating essential and nonessential foods should unfold their toxic effect from the gastrointestinal tract. This means that adequate quantities must be resorbed by the gastrointestinal walls. If this is not so, such substances are very quickly eliminated again unchanged after peroral ingestion, for example, mercury (II)- and strontium compounds. There is a certain relationship between peroral toxicity of inorganic compounds and their solubility in water which is rather striking particularly in compounds of one element or an entire group.

One thing that is by no means of minor importance to peroral toxicity of inorganic compounds is their ionizability. The toxic activities spring from the ions of the compound. They could be both cations and anions which, in keeping with their specific properties, act upon the organs.

When plotting the toxicity values of the cations against the ordinal number of the corresponding element, we discover a periodicity of the toxicity which was examined in greater detail by Nofre and others (see Figure 15.2).

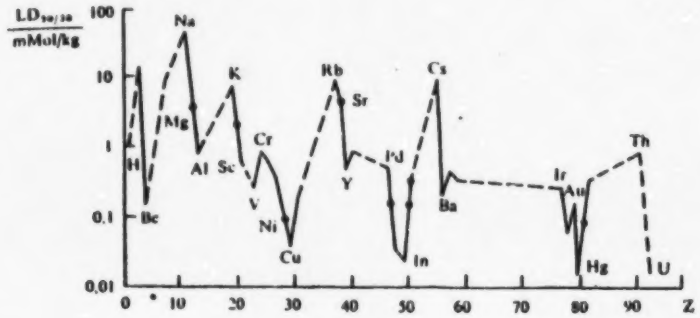


Figure 15.2. Toxicity of cations as a function of the ordinal number.

The relative nontoxic cations (maximums in the curves) are those of metals with negative normal potentials. The most toxic cations on the other hand are those of metals with a positive normal potential.

Table 15.5 shows the toxicity values of selected cations which were determined on male white mice, i.p., as LD_{50} (after 30 days).

As in the case of the cations, the toxicity of the anions varies greatly. Table 15.6 shows the toxicity figures for selected anions (conditions as in Table 15.5). The sodium compounds of the specific anions were used here (based on Nofre et al.).

Table 15.5.

Cation	LD_{50} mg/kg	Cation	LD_{50} mg/kg
Na^+	1024	$Co^{2+1)}$	20,6
Sr^{2+}	503	Tl^+	20,4
Th^{4+}	206	$Ag^{+2)}$	13,9
NH_4^+	163	$Zn^{2+1)}$	11,7
Li^+	99,0	$Ni^{2+1)}$	7,93
$Pb^{2+3)}$	76,6	Hg^{2+}	3,92
Cr^{3+}	46,8	$Cd^{2+1)}$	3,71
$Mn^{2+1)}$	43,9	$Cu^{2+1)}$	2,86
$Fe^{2+1)}$	39,1	Be^{2+}	1,35
Ba^{2+}	35,5		

Key: (1) As sulfates; (2) As nitrates; (3) As acetates.

Table 15.6.

Anion	LD_{50} mg/kg	Anion	LD_{50} mg/kg
$SO_4^{=}$	2255	$S^{=}$	7,05
NO_3^-	2166	$ScO_3^{=}$	4,44
Cl^-	1576	$TeO_3^{=}$	4,22
ClO_3^-	467	$AsO_4^{\equiv}$	4,17
ClO_4^-	448	CN^-	2,6
NO_2^-	106	$Se^{=}$	2,37
$CrO_4^{=}$	23,2	AsO_2^-	0,95
J^-	19		
$TeO_4^{=}$	7,15		

According to these figures, the compounds which might possibly be of military interest can be arranged in the following sequence in terms of their toxicity: NO_2^-, F^-, $AsO_4^{\equiv}$, CN^-, AsO_2^-.

In the case of possible sabotage poisons, such as $HgCl_2$, $PbCl_2$, and $BeSO_4$, the type of ion does not play any role. In these compounds, the cation is the active part. The use of chlorides, sulfates, nitrates, and acetates can be traced back to the good solubility of these compounds in water.

The properties of the following selected toxic inorganic compounds are generally known. They are potential sabotage poisons which can be used for this purpose in many different ways.

Compounds of the 1st Group of the Periodic System of Elements

Lithiumchloride

Although this compound is not very toxic, it can, when used in place of edible salt, cause severe poisoning symptoms. The NA^+/K^+ balance is upset by excessive consumption of Li^+.

Copper (II) Compounds, Especially Copper (II) Sulfate

Copper sulfate has a lethal effect in man at doses of 10-20 g when taken perorally. With the exception of copper canides, the other copper compounds are handly any more toxic. Copper compounds are resorbed only slowly in the intestines. Poisoning mostly leads to vomiting whereby a large part of the nonresorbed copper salt is eliminated.

Compounds of the Second Group of the Periodic System of Elements

Beryllium Compounds

Beryllium cations reveal the highest toxicity among cations. Fluoride and acetate are suitable as poisons. Although nitrate is soluble in water, it would

hardly seem to come under consideration because of the acid reaction. Beryllium-acetate has a health-damaging effect already in small doses. It displaces magnesium and calcium from their protein compounds and 20 percent of all contamination cases end in death.

Baryum Compounds

Among the baryum compounds, only baryum chloride is suitable because of its good solubility in water and possibly also baryum nitrate and baryum nitrite. Soluble baryum salts are quickly resorbed by the intestine. Death can take place in just a few hours. A quantity of 0.2-0.5 g $BaCl_2$ will already lead to severe contamination while 0.8 g can have a deadly effect. It was reported that 2 g are absolutely lethal.

Cadmium Compounds

Cadmium compounds in the past frequently appeared by virtue of food impurities, especially in case of sour fruit juices which were kept in cadmium-containing cans. Cadmium ions act as strong ferment poisons. About 50-60 mg, taken perorally, are lethal for man. Cadmium compounds are quickly resorbed in the gastrointestinal tract.

Mercury Compounds

Here especially the mercury (II) compounds have a toxic effect. A quantity of 0.2-1.0 g of mercury (II) chloride, when consumed perorally, will cause death in man. If $HgCl_2$ is introduced into the empty stomach, poisoning can end in death within 36 hours. But it can last up to 3 weeks before death takes place.

Compounds of the Third Group of the Periodic System of Elements

Thallium Compounds

Chloride, acetate, and sulfate of thallium are quickly resorbed in the organism, even through the skin. They have been used frequently in the past for criminal intentions. For Tl_2SO_4, the lethal oral dose is about 1 g. Deadly cases with 8 mg/kg of body weight or with 10-15 mg/kg body weight have become known.

Thallium compounds are cellular poisons. The poisoning cases usually last 2-3 weeks, while good health is restored 3-4 days after contamination.

Compounds of the Fourth Group of the Periodic System of Elements

Lead Compounds

Lead salts are easily resorbed by the mucosae in the mouth, by the respiratory tract, by the gastrointestinal duct, and even through the outer skin. They form insoluble complex compounds with albumin. Large doses of lead salts are absolutely deadly. The oral dose for lead acetate is about 5-30 g; 2-3 g will lead to serious poisoning.

Compounds of the Fifth Group of the Periodic System of Elements

Arsenic Compounds

Although all arsenic compounds are poisonous, only arsenic (III)-oxide or arsenious acid, possibly also arsenic acid--the latter above all in the form of its salts (arsenite, arsenate)--can be considered as sabotage poisons. Arsenic compounds were a poison that was in vogue for a long time. The lethal quantity for man in the case of As_2O_3 is about 60-120 mg. The toxicity depends on the poison's particle size. Arsenites are more toxic than arsenates.

Arsenic compounds are resorbed relatively fast in the gastrointestinal tract. They influence certain ferment systems and damage the capillaries. The contamination develops already after between 30 minutes and 3 hours, depending upon the quantity. Death occurs within 3 days due to respiratory arrest.

Antimony Compounds

Poisoning due to antimony compounds manifests itself in the same way as poisoning due to arsenic compounds. One substance which is particularly suitable as potential sabotage poison is so-called tartar emetic, also called potassium antimonyl tartrate, $K(C_4H_4O_6SbO) \cdot 0{,}5H_2O$, of which 100 mg have a lethal effect.

Inorganic compounds of other elements, with the exception of the fluorides, cyanides, and nitrites, could hardly be considered as potential sabotage poisons. Although the nickel and cobalt compounds are more toxic than perhaps the baryum and lead salts, they must be dropped because of their striking color. Among the salts, it is undoubtedly the cyanides which are the most toxic. Alkalicyanides and some others are easily soluble in water (basic reaction). They are just as toxic as hydrocyanic acid and they have the same effect as the former. About 110 mg NaCN or 145 mg KCN are lethal for man. Death takes place within 5 minutes in case of severe poisoning. The calcium balance is disturbed considerably (calcium precipitation) due to fluorides. A quantity of 250 mg sodium fluoride, when taken orally, will already lead to serious poisoning. About 5-4 g (as published) are reported to have a deadly effect. About the same deadly quantity has been given for sodium nitrite

The pertinent literature describes a vast number of poisoning cases with inorganic compounds due to conscious or accidental contamination.

[pp49-53]

16. Possible Use of Sabotage Poisons

Poisons can be used for sabotage purposes in very many different ways and their use can extend to tactical, strategic, or national economic objects. The purpose of their employment is to bring about death or the temporary neutralization of individual persons or groups of persons among military personnel and the civilian population. This may involve individual or mass poisoning. Sabotage poisons can be used both in the areas and during combat operations by subversives, special units, or aircraft.

Contamination targets can be water supply facilities, essential and nonessential foods, agricultural crops, livestock, and pharmaceutical as well as cosmetic products (according to Rothschild, especially foods no longer subject to further preparation, such as table fats, processed meat, dairy products, water and beverages as well as soaps and creams which have been overdosed or which have been poisoned by the addition of poisoned pharmaceuticals or by skin-damaging or percutaneously acting substances).

Rothschild believes that the strategic objectives of aggression would include the use of sabotage poisons for mass annihilation of combat units, of personnel at missile firing bases, of air force personnel, and of government and military command installations.

According to Schulzen ("Zivilschutz" [Civil Defense], Koblenz, 29, 1965, pp 264-271), acts of sabotage will be concentrated "mostly on large-scale drinking water contamination efforts as well as the most comprehensive possible destruction of useful animals." According to him, sabotage poisons "can be infiltrated already in peacetime by underground organizations with the help of false declarations and good camouflage. In case of war, sabotage teams can be supplied with sabotage poison by air. Sabotage agents can make highly toxic poisons if necessary from harmless substances by simple manipulation."

To poison drinking water, toxic substances should have suitable toxicity, water solubility, and hydrolytic stability.

As a relative criterion for suitability as sabotage poison, we can use the ratio between the substance's maximum solubility in water and the toxicity which is expressed as the degree of danger:

$$G_{water} = \frac{\text{Solubility in mg/l}}{\text{Lethal dose in mg/man (70 kg)}}$$

and which permits a certain estimate. The knowledge of the hydrolysis half-life makes it possible to judge the duration of contamination whereby it should be noted that this does not apply to possible inorganic sabotage poisons nor to most of the alkaloids which are stable in water. According to Table 16.1, VX, in addition to the toxins, has the highest quotient and is thus one of the most dangerous sabotage poisons.

Table 16.1. Degree of Hazard from Selected Warfare Agents and Poisons in Case of Drinking Water Contamination

Compund	G_{water}
Botulinustoxin A	10,000,000
VX	300,000
O-ethyl-S-(N,N-dimethylaminoethyl) methylthiolphosphonate	250,000
Sarin	100,000
Nicotine	20,000
Kolchizin	12,000
Hydrocyanic acid, cyanides	9,000
Amiton	5,000
Fluoroethanol, sodium fluoroacetate	1,500
Selenite	1,000
Arsenite, arsenate	1,000
Nitrogen Yperite (ammonia salts)	>800
Soman	<800
Thalliumfluoride	750
Strychnine sulfate	400
MFA, As_2O_3	250
Fluoride, nitrite	200
Nitrogen Yperite	1-25
Sulfur Yperite	20
Lewisite	5

Sabotaging the water supply can be accomplished by contaminating water sources including the supply pipelines and the treatment plants, in the water reservoirs of untreated and treated water, and in the main lines.

The WHO in its 1970 report gave some examples of the possible effects of drinking water contamination: in case of contamination with Botulinustoxin A, the theoretical quantity for 20 million liters of water, assuming complete distribution of the toxin, is 0.04 kg and in case of uneven distribution, the six-fold quantity must be assumed. The initial concentration upon introduction into the line network should be around 0.05 $mg \cdot l^{-1}$. If 0.001 mg/person have a deadly effect, then 20 ml of water will contain a lethal dose. Because the first symptoms occur after 6-8 hours, the contamination can be extended to 6 hours. In a city with 50,000 inhabitants, where about 0.5 liter of water per person is consumed, it must be assumed that at least 60 percent (30,000 persons) will have ingested a lethal dose during that time.

To contaminate the same volume of water under identical conditions with LSD, we assume 10 kg or, in case of uneven distribution, eight times that quantity (about 80 kg). In the later case, the initial concentration is about 10 $mg \cdot l^{-1}$. If we use a psychosis-triggering dose of 0.25 mg/person as basis, then that dose will already be contained in about 2.5 ml of water. Because the first contamination symptoms appear after about 1-2 hours, the contamination of the water would have to be completed after 1 hour. Here again the same number of persons will be contaminated under certain circumstances.

It should be kept in mind that water consumption rises during hot summer days so that far larger quantities of toxin will be ingested by the consumers. Because of the latency time of such poisons, it is however hardly possible to warn the consumers, to flush or purify the pipeline system, or to take other measures to eliminate the contamination.

Similar considerations can be entertained regarding the contamination of table fats, meat products, and other items. Here, the hazard levels are much higher because most of the substances considered for sabotage actions are well dissolved in fats and oils. Because there are no hydrolytic effects here, the required poison quantities would seem to be roughly within the same ratios as in the case of water. Of course, that will depend on the type of food and the average consumption quantity.

Poisons which act through the skin or which damage the skin are above all suitable for contaminating surfaces, such as the surfaces of equipment, clothing, gear, etc. These will hardly involve substances which volatilize too quickly, which are perceptible by means of odor, or where contamination could be recognized on the outside. Contamination substances and other organic phosphorus compounds, certain carbamates, alkaloids, as well as aconitin, toxins, and under certain circumstances also warfare agents such as the Yperites are suitable for this purpose.

The contamination of agricultural crops is possible by means of systemically acting organic phosphorus compounds and also by means of carbamates. By means of the use of high-percentage formulas, it is possible to contaminate living plants, their fruits, etc., in such a manner that mass contamination can appear in man and useful animals after consumption. The utilization possibilities here again can be very many, for example, by spraying, by dropping toxic substances in water-soluble capsules, and by poisoning water reservoirs used in sprinkling the fields.

The possible use of warfare agents and toxic substances for sabotage actions requires complex protection measures, thorough inspection and monitoring, as well as the screening of potential sabotage targets (see R. Stoehr, MILITAERWESEN [Military Affairs], 12, 1968, pp 451-541).

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Plant-Damaging Warfare Agents (Phytotoxins)

[pp 55-57]

Plant-damaging warfare agents, so-called phytotoxins, were made by the United States during World War II for use against agricultural utilization areas. Among thousands of compounds studied at Camp Detrick, the U.S. Army's biological research center, chemists found the so-called agent 2,4-D, also called 2,4-dichlorophenoxyacetic acid (a) as a compound suitable for military purposes. In 1945, 450 t of that substance were made. The idea was to wipe out Japanese rice fields in the summer of 1945. But this did not materialize because of the planned use of nuclear weapons.

Plant-damaging warfare agents are phytoactive chemicals or formulas thereof with which agricultural crops are to be wiped out in order indirectly to damage human food production through shortages or to prevent natural camouflage through defoliation.

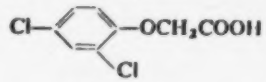
Herbicides, plant growth regulators, burning agents, and soil sterilization agents are of special importance here. Such agents have been used for a long time in agriculture and forestry as plant growth stimulators, to increase the yield, to improve the resistance of plants, for selective and total weed control, for defoliation or leaf removal from cultivated crops (to facilitate mechanical harvesting), for the production of seedless fruits, for eliminating underbrush, etc. On the civilian and military side this mostly involves the same groups of substances, although certain groups and substances are preferred for the individual sectors. The essential difference here consists in the fact that other "formulations" and larger quantities per surface unit are used for military purposes.

The plant's metabolism can be intensified by means of growth regulators. This is connected with an acceleration of physiological processes. Depending on the quantity of a phytoactive substance consumed. this can either help or harm the plant. Profound damage to the metabolism will lead to proliferations of the

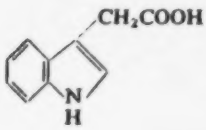
plant cell tissue, to growth inhibitions, and other phenomena which lead to the plant's death.

Initial knowledge on natural plant growth substances goes back to the laborious work done by the plant physiologists Boysen-Jensen (1907), N. G. Cholodny, and Went (1924), Koegl (1934), S. S. Nametkin (1940), and others.

After it was recognized due to their work that these growth substances contained heteroauxin, synthetically easily accessible β-[indolyl-(3)2-acetic acid (b), there was a solid foundation for further research in this field which was then also continued by military biologists in capitalist countries.



(a)



(b)

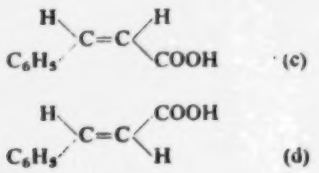
Phytotoxins were used for the first time between 1952 and 1954 on orders of the British High Command in Malaya (today Malaysia). The United States forces during their criminal 1961-1971 war in South Vietnam made comprehensive use of anti-plant warfare agents which caused ecological damage that can still not be estimated today. These agents were initially used with the intention of defoliating the jungle along strategically important traffic arteries and important objects and bases or to prevent any kind of plant growth and thus to impair the operations of the Vietnamese liberation army. In 1962, they began to use phytotoxins to destroy agricultural crop areas; rice fields, fruit plantations, and pasture land became favorite targets. According to official data, about 43 percent of the entire agricultural utilization area of South Vietnam (about 13,000 km^2) and about 44 percent of the forests (about 25,000 km^2) were poisoned in 1961-1970; in the process, the health of almost 1.3 million persons was damaged. According to American data, food for the nutrition of at least 850,000 persons per year was thus wiped out.

The use of plant-damaging warfare agents is a subject included in the strategic planning of the American military establishment for future warfare, including for war in Europe.

Some typical representative substances were selected from among the large number of phytoactive or phytotoxic chemicals and several of these were used by the United States in Vietnam and by Portuguese colonial troops in Angola.

These overwhelmingly involve photoactive compounds, apart from inorganic chemicals and their leaf-damaging agents, as well as those which in the molecule contain a ring-shaped grouping with at least one double bond. On the ring there

is a side chain with at least one carbon atom and one -COOH group or a functional group which can easily be converted into the carboxyl group. Besides, in some groups of compounds there seems to be a certain spatial relationship between the ring and the carboxyl group; this is the prerequisite for physioactive effect. For example, among the phenylcarbonic acid derivatives, cis-cinnamonic acid (c) is phytoactive and trans-cinnamonic acid (d) is not.



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5058
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DEVELOPMENT OF FLUID ADDITIVES FOR DEEP OIL, GAS DRILLING

Bucharest MINE, PETROL SI GAZE in Romanian No 3, Mar 82 pp 126-128

[Article by F. Popescu, Dr I. Ana, and M. Orosz]

[Text] The continued scarcity of hydrocarbons throughout the world has led, in the past few years, to intensified research to find new energy sources and to make better use of the existing ones.

In order to bring new reserves of hydrocarbons into economic circulation, in our country special efforts are being made to expand geological prospecting throughout the country, including the sea, especially prospecting at great depth (over 4,000 meters).

Under these circumstances, a number of extremely complex problems will have to be solved, such as:

--instability of the wellbore (collapse, excavation, choking of the hole) caused by the water-sensitive clay, by the strongly faulted, fissured and mineralized rock, by layers with abnormally high pressures (over 10^5 KPa) or with very low pressures (depleted);

--the intensified physical-chemical process caused by extremely high temperatures and pressures (175-250 deg C and over 10^5 KPa respectively) which degrade the rheological properties of the drilling fluid;

--increase in torque with increased depth;

--immobilized bit, drilling string or casing string;

--continuous increase in the content of corrosive gases (H_2S, CO_2) which, when coupled with high temperatures and internal tensions, cause an exponential increase in the speed of corrosion;

--higher circulation losses;

--slow progress at great depth and small diameter wellbores;

--mechanical and physico-chemical blockage of the productive formations;

--difficulties in pipe stringing, cementing, inspecting, and bringing the well into production.

One of the important aspects of well drilling and operation is the type and quality of the drilling, perforating, and packer fluids.

In addition to the traditional roles of the drilling fluid, such as:

--bringing the loose rock to the surface

--achieving the hydrostatic pressures necessary for control of the formation pressure

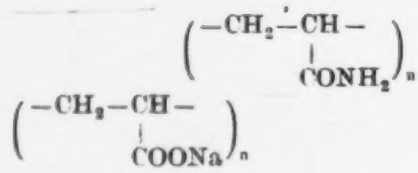
--cooling and lubricating the drilling equipment, etc.

these fluids must also help solve, or at least alleviate, the previously stated problems.

A number of additives are needed to provide drilling fluids which satisfy these requirements.

This article describes the additives currently used, classifies them by function, and points out their disadvantages for deep and for very deep drilling (over 4,000 meters and over 6,000 meters, respectively). It also describes the new additives for deep and very deep drilling developed during the past few years by research carried out at the Institute for Research and Design for Petroleum and Gases, at Cimpina, and shows the trends of future studies.

The additives presently used to prevent excessive penetration of the liquid phase into the strata and seal the walls of the wellbore have several drawbacks. Carboxymethylcellulose, for example, is thermally stable* up to 125-150 deg C and is relatively ineffective in the presence of electrolytes. Polyacryl amide and the polyacrylates are thermally stable up to 200 deg C, but are precipitated by calcium ions.



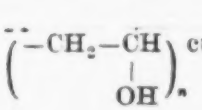
Research carried out at the ICPPG (Institute for Research and Design for Petroleum and Gases) has developed some wall sealants suitable for deep drilling, having high thermal stability, and which are effective in the presence of high concentrations of electrolytes.

*The temperature at which the polymers added to the drilling fluid lose their effectiveness.

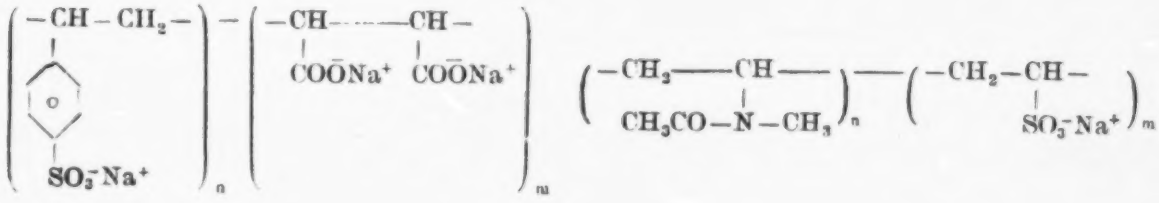
--FOREX (pregelatinized polysaccharide) is thermally stable up to 140 deg C and resistant to 300,000 ppm NaCl;

--LS-54 (sulfonated lignite) is thermally stable up to 200 deg C and resistant to electrolytes up to 300,000 ppm NaCl and 20,000 ppm Ca ions.

--APV (polyvinyl alcohol) is thermally stable up to 200 deg C and resistant to calcium ions contamination up to 50,000 ppm.



Continued research is being carried out for the development of some co-polymer-polyelectrolyte types of wall sealants of the sulfonated styrene-maleic anhydride type, of the N-vinyl N-alkylamide-vinyl sulfonic type, which are thermally stable up to 300-320 deg C and which are of special interest in drilling geothermal wells and 7,000 to 10,000 meters wells.



Fluidizers are additives which lower the excessive rheological properties of fluids caused by aggregation, by hydration and dispersion of clay particles, or by contamination with salt, gypsum, anhydrite. The currently used additives in this category are the ferro-chrome ligno-sulfonates with thermal stability up to 150-160 deg C, polyphosphates with thermal stability up to 80-90 deg C, and sodium humates which are thermally stable up to 175-190 deg C.

In order to provide a larger selection of fluidizing additives, the following were developed:

--chrome lignosulfonate (CLS) with thermal stability up to 170-180 deg C

--chrome-lignite (L_3) with thermal stability up to 200 deg C

--a tannin based resin TAN-21, obtained by condensation and sulfonation, with thermal stability up to 130 deg C, which is of interest because it does not contain toxic chrome ions and causes less pollution.

Other developments include aluminum lignosulfate and potassium lignosulfate which are of interest for various types of fluids, especially for offshore drilling.

Research continues toward developing fluidizing additives of the methyl-sulfonic-lignosulfonic resin type which are low molecular weight polymers and are thermally stable up to 250-300 deg C.

Surfactants are additives which lower the surface tension of the filtrate and thus increase the production of an operating well. They are highly effective in forming emulsions (lead to light fluids used to lower circulation losses) and inhibit the hydration and dispersion of clays (by forming monomolecular films). Research has resulted in some effective surfactants with high thermal stability (200 deg C) such as the following:

AAS--9 nonylphenol ethoxylate

$$C_9H_{17}-\langle o \rangle-O(CH_2-CH_2O)_nH$$

AAS--4 sodium alkyl-aryl sulfonate and sodium humate

EG--96 monoethylene glycol oxypropylate. These are effective additives and are not sensitive to calcium ion contamination. We should mention here that the previously used naphthenic soaps precipitate in the presence of calcium ions.

Further studies are being carried out to develop high molecular weight surface active agents with high inhibiting action of the alkyl and polyalkylphenol polyglycol type.

$$R-\langle o \rangle-O(CH_2-CH_2O)_nH,$$

Developments in the area of corrosion inhibitors include a consumer (scavanger) of H_2S based on Zn humate and $ZnCrO_4$. This additive precipitates the H_2S according to the reaction:

$$Zn^{2+} + S^{2-} \rightarrow \underset{\downarrow}{ZnS}$$

An oxygen consumer, based on catalyzed sulfites, scavanges the oxygen from the drilling fluid according to the reaction:

$$SO_3^{2-} + 1/2\ O_2 \rightarrow SO_4^{2-}$$

The advantage of these consumers of H_2S and O_2 is that they do not affect the rheological properties of the drilling fluids and have a higher thermal stability than the peliculogen type inhibitors, based on amines.

Another problem to be solved is the jamming of the bits, drill strings, and casing strings because of "differential adhesion" to the deposits formed on the well walls by the higher hydrostatic pressure at the level of highly permeable strata. A newly developed additive, AD, consisting of a mixture of non-ionic and anionic surfactants has been developed for this purpose. The additive is dissolved in fuel oil or in a basic petroleum product, made heavier, and pumped into the area of the adhesion where it fissures the deposits and permits the fluid to penetrate in the cracks. By reducing the area of contact between the deposit and the drill string, by equalizing the pressures, and by providing lubrication, the drill string is being freed. There is a major advantage in using the above material: it helps recover the part of the wellbore which does not need to be re-drilled and also the drilling bit.

This product has been used in 20 wells and has solved 90 percent of the cases of jammed drill strings (at depths of 2,500 and 5,000 meters), as compared to 45 to 50 percent claimed in foreign technical literature).

A new lubricant, LFF-2, has been developed in order to reduce torque. It is based on a mixture of esters which do not influence the rheological properties of the drilling fluids, it is compatible with all types of drilling fluids, has thermal stability up to 150-175 deg C and reduces the friction coefficient between the drill string and the wall by 30-50 percent, depending on the type of drilling fluid.

Another additive, INHIB, has been developed to stabilize the water-sensitive clay rock. It consists of a mixture of macromolecular substances and dicromates, and, when added in amounts of 3-5 percent to water-based drilling fluids, reduces considerably the hydration and dispersion of clay particles.

Clay rock is not only water sensitive, but also has micro-fissures which make the wellbore much less stable. To help drilling through clay rock, a new product was developed, known as SGS, which consists of powdered bituminous asphalt, sodium humate and a non-ionic surfactant. This product seals the micro-fissures by providing a binder and also turns the clay into hydrophobic particles.

In the past few years, studies carried out at ICPPG-Cimpina have resulted in a number of additives, such as:

EMROM--emulsifier (calcium and sodium soaps of the fatty acids and surfactants)

ASAL--filtration diminisher (asphalt sulfoxydate)

OFP-82N--moisturizing agent

These additives have made possible the development of a new type of drilling fluid based on continuous phase petroleum products, fuel oil, in which a solution of $CaCl_2$ is dispersed as an internal phase.

The fluid thus obtained is called an "inverse emulsion" or an "oil fluid" depending on the water content (10-35 percent by volume or 5-10 percent by volume, respectively).

This type of drilling fluid has made possible the drilling of very deep wells under especially difficult conditions.

The well drilled and now in production at the Magurele formation has a depth of 5,920 meters, temperatures of 180 deg C and pressures of 10.3 10^4 KPa. The drilling fluid used was of the "oil fluid" type, with a density of 2,200 Kg/cubic meter.

At other wells, such as Margineni, Piscuri, Bustenari, the drilling proceeded normally up to depths of 5,000-5,500 meters, while using "inverse emulsion" drilling fluids. This would have been impossible to achieve with a water-based fluid.

At the moment, the well being drilled at the Baicoi formation is at 5,000 meters and "oil fluid" type drilling fluid will be used to drill down to 6,500 meters.

In addition to this type of drilling fluid, the newly developed additives have opened other possibilities.

The use of surfactants (AAS-9, EG-96, TENSROM) in the Bibesti formation has resulted in a fluid with a low solids content and this has led to considerably higher advance speeds.

Especially good results were obtained by developing and using the "INHIB-KCl" type drilling fluid, in the field. In addition to the 3-10 percent KCl, this fluid contains the INHIB, EG-96, etc. additives. The performance of this type of drilling fluid comes close to that of the "inverse emulsion" fluid (this has been proven in the field in several wells, including offshore drilling). This development should result in the gradual replacement (where possible) of drilling fluids based on petroleum products).

In conclusion, we feel that, as a result of our own research at the drilling fluids laboratories at the ICPPG, Cimpina, we have developed additives and drilling fluids which have made possible the drilling of wells under most difficult circumstances, at depths exceeding 6,000 meters, and also helped find rapid solutions to major difficulties which occurred in these drillings.

1632
CSO: 2702/7

INCREASED PRODUCTION OF SOLAR COLLECTORS URGED

Bucharest SCINTEIA in Romanian 9 Apr 82 p 2

[Article by Elena Mantu and Corneliu Cirlan]

[Text] During the current five-year plan and until 1990, as stipulated in the decision of the recent plenary session of the central committee of the RCP regarding the fullfillment of the electric power production program, the contribution of new energy resources will have to increase in the country's energy balance. Among these new sources, solar power is of immediate practical value, and is an area in which research and applications are well on their way.

Without delving insistently on the efficiency of exploiting this natural source of energy, let us look at one figure: 260,000 tons of conventional fuel (cc), whose oil equivalent would cost nearly 50 million dollars. This is the amount of primary energy that must be saved during 1985 by exploiting solar power. In order to achieve these savings, 475,000 housing units, hotels, motels, camping areas, and washrooms in many enterprises must be equipped with solar water heating units. At the same time, plans are being made for water heating installations for technical purposes in industrial units and animal raising farms, as well as for obtaining hot air to dry fruits, grain, wood, construction materials, and so on.

What major types of solar collectors are presently offered by research and production?

To be sure, the three types of solar collectors have each their advantages and disadvantages, because we are still beginning to manufacture them. The current problem is to intensify the fabrication of those that have the best technical performance and economic efficiency.

What do we learn from discussions with specialists? Researchers at INCERC (Research Institute for Constructions and Construction Economy) and ICSITEEMR (Institute for Scientific Research and Technologic Engineering for Power Equipment and Hoisting Machinery) estimate that the Sadu collector, which received a prize at the Moscow Inventors and Innovators Show in October of last year, certainly has the highest energy yield, a longer life than other types, and a broader field of applications (in installations that are large and small, simple and complex, with thermal siphoning, and without pumps); the collector is easy to manufacture, easy to install, and easy to maintain. Its disadvantage is that it requires about 13 kg of

Specifications	Sadu aluminum plate collector	Alexandria collector	Frigocom collector
Weight	59 kg	70 kg	62 kg
Aluminum consumption	13 kg	3 kg	--
Steel consumption	17.87 kg	42 kg	45 kg
Energy contribution	187 kgcc/yr	120 kgcc/yr	122 kgcc/yr
Price	2226 lei	1769 lei	1769 lei

aluminum, an energy intensive material; but the specialists have already found ways to reduce this consumption of aluminum. The characteristics of the Alexandria and Frigocom collectors are similar. The difference between them is only that the Frigocom unit does not use aluminum, that the coil is protected against corrosion, that it can also be used directly without a heat exchanger, and therefore with higher reliability, and that is has a constant yield which does not depend as much on the amount of sunshine, which means that it can also operate well in locations which are less sunny or receive diffused light.

Does the use of these two types of collectors lead to any savings? Some options are based on the fact that aluminum is a metal whose production requires a large amount of energy, and that it must not be used unless other solutions are not available. A wise attitude to be sure! But in the opinion of the specialists, the use of aluminum in solar collectors must be analyzed more thoroughly and considered more carefully, because calculations have shown that in order to obtain a given amount of power, 2 square-meters of Sadu collectors correspond to 2.60 square-meters of Alexandria ones. In this case, under comparable conditions, the energy included in the material used to fabricate the collectors is 246 kgcc for the Sadu type and 256 kgcc for the Alexandria. Consequently, no savings of primary energy result from the use of steel collectors instead of aluminum ones. And one of the advantages of the aluminum collectors is that they have a significantly longer life and reduce specific investments. Therefore, still under comparable conditions, the energy incorporated in aluminum collectors is recovered through the exploitation of solar power in only 1.6 years, compared to 2.1 years for the Alexandria type.

We have looked at the operation of the two types of collectors, the Alexandria and the Frigocom (made out of steel). At the Bucharest Enterprise for Tooling and Spare Parts, 324 Frigocom panels were installed last summer on the roof of one building. During the short period of its operation last year, the installation supplied hot water for the needs of the enterprise, for a savings of 10 tcc. During this year, it is estimated that its use for the entire optimum sunny period (April to November) will lead to a savings of 41 tcc. In practice, the installation produces more hot water than the needs of the enterprise, and a search is being conducted among neighbors for an eventual user of the surplus. As we have observed, the collectors survived the winter well, did not rust, and since the glass is well washed by a simple rain, required little maintenance.

During the same period, 254 Alexandria collectors were installed at the Energoreparatii enterprise in Bucharest. It is estimated that the use of this installation has saved 13.2 tcc in one year. How did it fare during the winter? All the panels, made of primed sheet metal, have rusted to some degree or other. One more winter and no one knows what will be left. Many of the panels have become

dulled (oxidation of the aluminum reflectors), thus reducing the installation's efficiency. The glass panels are not water tight, and the steel tubing coil is oxidized in places, with the rust staining the reflector. The situation is similar at other units that have this type of collector.

What is the producers' position in all this?

Eng Gheorghe Dorin Vieru, director of the Frigocom Enterprise: "We were asked to reduce the price of our collector, and found ways to bring it to the level of the one made by Alexandria, while retaining the operating specifications of the product. We could reduce the cost of the collector even further, but when the price was approved we were assigned a profitability of 19 percent, which in fact does not reflect the real efficiency in the fabrication of this product. We are prepared and have organized manufacturing lines for at least 40,000 collectors per year."

Chief Engineer Zoie Popescu, at the Alexandria Enterprise for Equipment and Accessories: "Since 1977, when we began the fabrication of solar collectors--as a national specialized enterprise, we have strived to assure a constant improvement in our products. We accepted the recommendation of specialists to improve the anticorrosion protection of our collectors, and we took the necessary steps without increasing production costs. We could sell the panels at a lower price, but we were assigned a profitability of 16 percent over production costs, which in our opinion is exaggerated. If we had orders (which unfortunately we do not), we could produce 200,000 collectors per year."

These are the opinions of specialists and our findings. We have raised the question of solar collectors, because a recent decision of the specialized organs in the State Committee for Planning, based on the good intention to guide the fabrication of these installations, stipulates that Alexandria solar collectors must be used in 1982, since the Sadu collectors are no longer made due to their high consumption of non-ferrous metals and their high cost. But as we have seen, this is the type of installation that has disadvantages compared to the others. That is why, echoing the position of the specialists, we propose the organizaiton of a meeting of decision makers with specialists in research, planning, and production, and with users as well, to thoroughly analyze the existing solutions, starting with the general interests of the economy and the concrete possibilities of manufacturing, while taking into consideration the need to place these units on foreign markets. The adoption of a decision must of course also include the idea, which we deem a good one, that the fabrication of solar collectors should become the task of several enterprises, especially since the implementation objectives for these installations are very large and must be fulfilled in a very short time.

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CURRENT STATUS OF MICROPROCESSOR PRODUCTION

Bucharest SCINTEIA in Romanian 9 Apr 82 p 3

[Article by Vlaicu Radu]

[Text] The most indicative picture of the technologic explosion of recent years in the electronics field seems to be the one painted by a specialized institute, which pointed out that if the revolution in the electronics industry had occurred in the automotive industry, a Rolls Royce would cost five dollars, and it would be possible to cover 500,000 km at 500 km/h with a single liter of gasoline. The progress in electronics is a truly unique phenomenon in the history of technology. Moreover, in predicting the development trends in this field, some experts believe that everything that has already happened is only a prologue, and that electronics will remain one of the most important and dynamic technologies of modern civilization.

The development of semiconductor production and miniaturization technologies have been decisive factors in the evolution of electronics. Microelectronics--the fabrication and use of highly miniaturized electronic circuits--is today the most representative domain in the evolution of present electronics. The level of miniaturization currently practiced in the microelectronics of large scale integrated circuits available on the market, places more than 10,000 transistors on a silicon wafer with an area of 50 square-mm, and laboratories are working on structures which have more than 100,000 components.

Dr C. Bulucea, director of the Research Institute for Electronic Components, told us what these figures mean in physical terms: "If we were to miniaturize a newspaper page which contains 35,000 characters, at the same level scale as large scale integrated circuits, we would have to engrave it without any defects, on the surface of a postage stamp; the engraving would have to be done with letters in relief, precisely defined, and colored in seven colors, one of which would have to be metallized! If we were to work at the scale of very large scale integration, the entire newspaper could be engraved on the same area. Although it seems difficult to believe, such things are entirely possible, since the current technology disposes of an arsenal of material processing techniques, which properly used, can lead to the production of structures that can be engraved on silicon with the dimensions and characteristics described above."

Perhaps the most spectacular achievement of the past ten years in the area of highly integrated circuits, is the microprocessor, which is essentially a central computer unit in the form of a single integrated circuit. In its structure, the microprocessor includes over 5000 transistors implanted on a silicon area of approximately 20 square-mm. By adding integrated circuits for memory, interface circuits, and so on, to this central computer unit, it is possible to build a complete computer system called a microcomputer, whose data processing capability is that of a conventional closet-size computer, but whose dimensions are those of an attache case. In fact, the complete list of microprocessor applications is for the time being limited only by our imagination. Microprocessors are being built today, which can evaluate and direct complex processes performed by robot machines, without manned intervention and placed at man's service.

Remarkable in this respect are the foresight and understanding of this field's future on the part of our party's leadership, and of its secretary general, Nicolae Ceausescu, whose constant attention is directed toward the evolution of Romania's electronics. It is entirely natural that the development of microelectronics, including the production of microprocessors in Romania, would be considered as tasks of the greatest importance for the electronics field in the Program-Directive for Scientific Research approved by the 12th Party Congres. We have presented this review of an unprecedented revolution in the history of technology, not only to show the importance of the impact of science and technology on the development of electronic components, but also to provide a reference point for assessing the efforts that our country makes in the electronics field.

The production in Romania, in the near future, of large scale integrated circuits, including microprocessors, is taken by our specialists as a highly responsible task, because even though microprocessors have insignificant weights and dimensions (they weigh less than 10 grams), they constitute a major investment and concentration of talent. But as Dr Bulucea points out, while the advantages deriving from the use of microprocessors are well-known and publicized, it is less well known that their fabrication requires advanced-technology, computerized (some in fact, with microprocessors), special installations and equipment, produced only by a few foreign companies, which operate only in areas with temperature, humidity, dust-free, and vibration-free conditions that have so far never been achieveed in any branch of our national economy. Moreover, our engineers are handicapped from the start by the export limitations of some countries which have equipment and technologies specific to the microelectronics industry. In this situation, the manufacturing and use of microprocessors in our country will have to be handled through the parallel and combined efforts of applications specialists and semiconductor specialists: while the former carry out projects and build prototypes with imported components, the latter create the necessary materials foundations, following which they will design and produce the much awaited microprocessors.

But in addition to electronics experts, the fulfillment of this objective requires the active and efficient support of the other sectors of the economy. Microelectronics is a technology of perfection, which demands the acquisition of advanced techniques in chemistry, metallurgy, machine construction, and so on, all of which will have to assure the domestic production of the ultrapure and special materials needed by this industry.

Given the capabilities of our specialists, and the investment support provided by the state as part of the priority microelectronics program, the promise made to the secretary general by the leadership of the Microelectronica Enterprise, to produce the first large scale integrated components as early as 1982, is a realistic one.

The responsibility of all involved in the completion of this objective is enormous, if one considers the fact that the potential of the Romanian industry can be exploited with maximum efficiency only by incorporating on an increasingly broad scale, automated and computerized installations that have evolved at the present level of electronics throughout the world.

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END

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10 August 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 751

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10 August 1982

EAST EUROPE REPORT
SCIENTIFIC AFFAIRS

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ASTRONAUT ON CSSR-USSR COOPERATION IN INTERCOSMOS PROGRAM

Prague RUDE PRAVO in Czech 28 May 82 p 6

[Article by Lt Colonel Eng Vladimir Remek, CSSR pilot-cosmonaut, hero of the CSSR and hero of the USSR: "Cooperation with the USSR and the Intercosmos Program"]

[Text] Economic scientific and technological cooperation between Czechslovakia and the Soviet Union is a steady source of values whose extent, especially in the progressive scientific fields and key technology, we can hardly estimate. Space research has a firm basis in the cooperation of the two countries today, especially as a component of international cooperation of socialist countries in the exploration and use of the universe in the Intercosmos program.

The official date for the beginning of the Intercosmos program is April 1967, when the delegations of socialist countries at the Moscow meeting dealt with the basic questions of cooperation in space exploration and targeting of their efforts in four main directions--space physics, space biology, space meteorology and space communications. Cooperation between the Soviet and Czechoslovak specialists had been evolving in this field even before this date, both in laboratories and in Czechslovak participation in experiments of the Soviet national space program.

Broader participation in space experiments was made possible in 1965 when the USSR offered to make available the free use of the newest space technology to all socialist countries within the framework of peaceful exploration and use of space. Czechoslovak participation in space exploration acquired a new dimension in the fall of 1969, when the first Intercosmos satellite was launched on 14 October to study the sun's radiation, and shortly afterwards when the Intercosmos 2 satellite with a program for study of the upper atmospheric strata was launched in December. In July 1976, during the signing of the new government agreement on the Intercosmos program, the Soviet delegation suggested that experiments be expanded from satellites to manned Soviet spacecraft as well. Czechoslovakia already had to its credit numerous successful accomplishments in the peaceful exploration of space.

Czechoslovak science participated significantly by installing and preparing experiments in all 15 Intercosmos satellites launched thus far, as well as in "Vertical" geophysical rockets, the first of which was launched in the Soviet Union on 28 November 1970. Not only were there achievements in the basic

research of space physics and astrophysics, biology, medicine and the like, these were augmented by geophysics and other fields in 1975 when the program was expanded in a fifth direction--the remote exploration of the Earth. The results of research in space communications also terminated in the signing of an agreement to create the international "Intersputnik" system and organization which had its tenth anniversary last year.

Manned space flights in the Intercosmos program, when cosmonauts of socialist countries work side by side with the Soviet Cosmonauts as international crews orbiting the Earth, have sometimes been called a turning point in the whole development of this program. I believe that these flights, and thus my space flight as well, were merely the logical conclusion, or better expressed, expansion of the preceding cooperation in the peaceful exploration of the space. The development reached the stage when even in those socialist countries which until had been utilizing only satellite technology, it was possible to prepare experiments for manned flights because the Soviet Union generously offered us the space in the spacecrafts and aboard the space stations. In my life, however, the first manned flight of the Intercosmos program meant a great deal--it was a true milestone. Besides the unforgettable experiences in the preparation for it and from my own space flight with Commander Aleksey Gubarev, it changed my work. Although I remain a military pilot and fly regularly, most of my time is now taken up by research in the field of space navigation, for example, and other correlated studies.

I will remember forever the often infinitely long days of demanding training, but also the people who were always willing to help and encourage us. This was how the Soviet cosmonauts and other workers of the Yuri Gagarin Center for Cosmonaut Training behaved toward myself and other comrades preparing for the joint flight. For the first residents from the socialist countries in "Star City", it was not only demanding training for the space flight but it was also an entirely new path for space science--preparing for the flights with international crews. The Soviet Union thus showed to the whole world that in its dealings words and deeds are not at odds, that it has unselfishly opened the way to space to other countries as well. The flights of the first international crews of all member countries of the Intercosmos program were accomplished, the path was opened, and today we are standing before another important event: at the threshold of a joint Soviet-French flight in the Soviet spacecraft Soyuz T and the work of the international collective aboard the Salyut 7 space station. This has confirmed that not only socialist countries but others as well, can use Soviet space technology for peaceful exploration of the universe.

Recollecting my own space flight--even after more than 4 years--I have the feeling that it was yesterday. On the other hand, a look at what Soviet science has achieved in space research in those 4 years suggests a far greater lapse of time.

After our first flight in Soyuz 28 to the Salyut 6 space station, there were flights of eight other international crews in Soyuz spacecraft. At the same time, however, as early as 1980, the new Soyuz T spacecraft was tested which can transport three cosmonauts into orbit around the Earth and to the space

station. Beside providing greater comfort for cosmonauts, this spacecraft has many new features to automatically control and check the spacecraft's systems; among other things, some piloting, orientation and stabilization functions of the craft are insured by the onboard computer. There is a large number of technical innovations aimed to increase the safety of space flights and the expansion and better quality of scientific experiments. And as for making the life aboard the space station more pleasant and comfortable, particularly for long flights, expanded communications of cosmonauts with the Earth by two-way television transmissions are an important feature. When we were flying, the Earth could see us. It is a significant advance that today it is possible to speak with and at the same time see friends and family, to watch a television program, even if only briefly, and to see, if the need arises, the details of a problem being solved that can be shown by the specialists from the control center.

All improvements and all knowledge and experiences acquired from further operation of the Salyut 6 space station were utilized in the new Salyut 7 station. Beside being better equipped with scientific devices and instruments it also provides better comfort for cosmonauts; for instance, perceptible reduction of operational noise during rest and sleep periods.

Beside technical advances in the spacecraft design and required instruments and other equipment and systems, significant progress was also made by biologists and physicians. For example, the regular crew of Salyut 6, Yuri Romanenko and Georgi Grechko, who brought us on board, at that time set the record of 96 days in Earth orbit. Since then, two Soviet longtime crews spent 6 months in space, all without any special effects on the human organism and with very quick adaptation of cosmonauts after their return to Earth. Moreover, as we know, the work ability and physical and mental states of these crews were good to excellent in every case. This is clear evidence of the marked progress in the development of biological and medical space sciences, whose representatives are convinced that even today the stay in space can be further prolonged.

In the development of Soviet manned flights we must also mention the Cosmos 1267 satellite, which by its mass practically corresponds to the Salyuts; today scientists are testing in it technological elements connection with the Salyut 6 station, which will lead to changes in utilizing near space for scientific and the national economic needs--modular orbital stations.

Even though flights to distant planets do not yet belong fully to the exploration of the Intercosmos program, we cannot leave them unmentioned. After all, the successes of the exploration of Venus achieved by the latest Soviet interplanetary stations Venera 13 and 14 this past March [1982], and the data obtained from this planet have also been used by socialist scientists. Moreoever, experts from socialist countries will participate in the preparation to explore Halley's comet. Czechoslovak science was entrusted among other things with the task of developing and setting up an oriented base which will house the necessary measuring instruments.

Concurrently with the development of Soviet space technology and space experiments, research in the framework of the Intercosmos program was also expanded. The first stage of manned flights of international crews from

socialist countries has been terminated, but this reasearch goes on. Individual socialist countries prepared scientific experiments and also helped with the needed instruments and equipment, many of which became standard equipment on the Salyut space stations. The experiments themselves are continuing in various programs of subsequent crews of the space station and the results are provided to the laboratories of the individual countries.

After the conclusion of our flight, the Czechoslovak space effort was seemingly reduced. This is not so. Additional Intercosmos satellites have been since introduced in Earth orbit. Of particular importance to us was the "Intercosmos" 18 satellite, from which the first Czechoslovak satellite "Magion" separated on 14 November 1978. It was an important outcome of the cooperation between Czechoslovak and Soviet experts. Biological experiments also continued, primarily using Soviet "Cosmos" satellites. Work of Czechoslovak scientists in the processing of the data of past space experiments and preparation of new ones is extensive. A review of the work of collectives in the laboratories of the Czechoslovak Academy of Sciences, at the universities and some departmental institutes in the past year, for example, can provide the picture of our activity.

In 1981, in the field of space physics the processing of telemetric data from the earlier launched satellites Intercosmos 18, 19, Magion and Prognoz 8 continued. The Czechoslovak and Slovak Academies of Sciences continued their cooperation with the School of Mathematics and Physics of Charles University and departmental institutes in the development of scientific equipment for the "Intershock" project (study of shock waves in interplanetary space), for a space probe destined for the flight to Venus and Halley's comet, and in preparation for experiments involving manned space flights.

The year 1981 saw the launching of the "Vertical 9" rocket which carried two Czechoslovak X-ray objectives and of "Vertical 10" for which our specialists developed and produced an instrument for measuring the angular distribution of the intensity of charged particles in the magnetosphere. Last year, after being active for 3 years, the "Magion" satellite perished. It provided a magnitude of data which were processed as received. Analysis of the data from Czechoslovak instruments placed aboard the "Prognoz 8" satellite continued, and the catalog of X-ray effects was completed from earlier measurements of long-range sun activity on board "Prognoz" 5, 6 and 7.

In the Institute of Geology and Geotechnology of the Czechoslovak Academy of Sciences the study of lunar soil samples has continued. For measuring purposes of the "Bulgaria" 1300 satellite, workers of the faculty of nuclear and physical engineering of the Czechoslovak Military Institute of Technology put into operation a laser radar of the first generation and started revitalizing the second generation of satellite radars of the Intercosmos network.

In the field of space technology our workers in the Institute of Physics of the Czechoslovak Academy of Sciences, in cooperation with the development workshops of the Czechoslovak Academy of Sciences, desinged a new "Krystalizator" device which will be used in orbiting laboratories. In the field of

space meteorology, a set of programs for processing multichannel picture information from meteorological satellites was tested last year. The data are processed in digital form, the programs can be adjusted for any meteorological satellite and can be used with any computer. Space communications workers developed a second class land receiving station and assigned it to the experimental area in the Soviet Union for testing.

In the field of space biology and medicine, the long-term "Stres" experiment was complted; it involved placing laboratory rats in a Cosmos statellite and at the same time carrying out model experiments on Earth. Analysis of biorhythm experiments on board Cosmos 1029 have been completed, as had analysis on additional biological research projects. Development of Czechoslovak instruments for manned and unmanned spacecraft and preparation of appropriate biological and medical experiments for bio-satellites and space stations has also continued.

At our workplace, in addition to other things in the past year we also continued research in the field of space technology; for example, preparation of a methodology for the utilization of brief periods of weightlessness on L 39 aircraft; utilization of a centrifuge for preparation of technological experiments, and testing of instruments for research projects aboard the space station. To a lesser degree we are participating in the design of an oriented base for the Halley's comet probe and we continue analyzing the data obtained from space navigation and work on other partial research tasks.

These are only some of the results and work of Czechoslovak space research in the past year. At the present time, in their everyday life, our citizens are sharing space communications and space meteorology--through television broadcasts, long-distance telephone calls, weather forecasts, and the like. In the Soviet Union it is also remote Earth exploration which provides great values for the national economy. The time is not far away, however, when this trend of space exploration will also provide a practical contribution to our economy, just as will space technology or other fields of space exploration later. Today, it is very difficult to estimate the enormous contribution of peaceful space science for humanity in future years. In the 25 years of the space era--this fall we shall commemorate the launching of the first Sputnik which foretold one of the most progressive trends in current science--in cooperation with the USSR, our scientists have been able to participate in its development for two-thirds of the existence of the space era; not only in the laboratories but in cooperation with Soviet experts even beyond the boundaries of our planet on using satellite experiments and manned spacecraft and space stations. With the use of the latest space technology our scientists were able to raise their share of contributions to the peaceful exploration of the universe.

9562
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CSSR-USSR COOPERATION IN AGRICULTURAL SCIENCE AND TECHNOLOGY

[Bratislava EKONOMIKA POLNOHOSPODARSTVA in Czech No 6, 1982 pp 241-244]

[Article by Engineer Emil Cakajda, 1st Deputy Minister of Agriculture and Nutrition of CSSR, Anatoliy Aleksandrovich Pomorchev, Deputy Minister of Agriculture, USSR]

[Text] Scientific and technical cooperation between the CSSR and the USSR is founded on a long tradition. It penetrates all areas of agriculture and contributes unquestionably to it. Cooperation with the All-Union Academy of Agricultural Sciences, name of V. I. Lenin, as well as with a number of all-union Soviet research institutes and research institutes of the Soviet republics, has meant a great deal for Czechoslovakia. It has meant a contribution toward the development of both traditional and new professions concerned with basic, specialized and applied research. It actually contributes to bolstering the research base and to mesh research with practical application.

It was precisely Soviet agricultural science which influenced Czechoslovak agricultural science as long ago as the time between the two world wars. This was accomplished by direct contact between the All-Union Academy of Agriculture, name of V. I. Lenin, and the pre-WWII Czechoslovak Academy of Agriculture. In spite of the provisions of the bourgeois state apparatus numerous contacts with representatives of Soviet agricultural science and progressive Czech specialists were established, under the influence of the CPCZ and other enlightened elements. As a result, starting in 1924, some Soviet scientists who were endowed with unquestionable scientific authority gradually became honorary or corresponding members of the agricultural academy as it existed then. Direct information about Soviet agriculture, which was not ideologically distorted, started to appear in the CSSR, especially starting in the 1930's. At that time a number of papers by leading Soviet scientists were published among them we may cite: Michurin, Tsitsin, Pryanishnikov, Prasolov, Nestrejov, Glinka, Vavilov, Kolesnev, Swircevskiy, et al.

After 1945 and especially after 1949, Czechoslovak-Soviet scientific cooperation in the field of agriculture achieved fresh start and gradually intensified, especially with regard to village socialization. In addition

to studies and to adaptation of Soviet experiences to our own situation, another major factor was the considerable Soviet material, technical and foodstuff assistance for Czechoslovakia. With the development of Czechoslovak socialist science and research the scientific and technical cooperation has been gradually increasing.

Cooperation in Breeding Experiments and in Agrotechnology

The main stress was on the development of the grain production which started in latter half of the 1960's. It is no accident that progressive increases in winter wheat yields occurred in the CSSR starting in 1967, at which time the Soviet variety Mironovska 808 occupied a considerable amount of the sown acreage. The Mironovska variety which provided the major part of the acreage sown to wheat has been an outstanding stabilizing element in grain production in Czechoslovakia during all three latest five year plans.

Mironovska variety was intensely cultivated in the CSSR starting in 1967 and in that period more than 3 million tons of high quality grain were produced. Due to their outstanding economic and biological qualities Soviet varieties were widely utilized in breeding programs as well. On the average they were used in 65 percent of the crosses which were carried out in breeding stations. They were also used because of large ear production, of resistance to cold weather and grain quality. During the years 1976-1980 using Soviet varieties as a base 10 new wheat varieties were bred and released for use--Slavia, Hela, Juna, Mirela, Vala, Odra, Solaris, Istra, Amika and Kosutka.

Soviet specialists on the other hand have used Czechoslovak genotypes to breed spring barley in the Ukraine. The most promising of these materials--according to tests done at the Mironovskiy Institute--are new crosses KM 38-336-75 and KM 5-250. These have been grown in an accelerated program at the Kironovski Institute in experiments to gain better yields in various parts of the Ukrainian SSR. It is assumed, for example, that in 1982, the strain KM 38-336-75 could be included in state experiments in the USSR in a combined study of different varieties. Thus gradually scientific and technical cooperation has been encompassing wider areas.

There is broad cooperation in working on the whole complex of questions involved in the technology of cultivation, harvesting and handling of hops. In 1976 a bilateral agreement was signed concerning these problems and 1978 was designated as the year in which two temporary international collectives were to be formed. The first temporary collective, based in the CSSR, was aimed at solving the problems mechanized cultivation, harvesting and post-harvest handling of hops, and the second one, based in the USSR, was aimed at the study of genetics and breeding of hops.

Czechoslovak and Soviet scientists of the first collective constructed a suspended platform to be used with a tractor in order to attach the hops which had already been arranged in bundles. As a result of this joint project both countries produced working models of special equipment needed to prepare these bundles. Mobile platforms were successfully tested

operationally both in the CSSR and in the USSR with the resulting recommendation that hop-conductors ought to be suspended directly on the ceiling of the hop carrier without using any hooks. A further development was the joint project of the hop handling construction SCHK-79 using a minimum of construction materials. These experimental hop-stations were built on a area 0.2 hectares in size in both countries.

The second international collective worked out a method of accelerated development of varieties of hops in 6-7 years, and produced a model with basic parameters of varieties which corresponded to basic breeding needs of both countries. During this cooperation an intensive exchange of selected seeds and planting materials took place. In addition, two joint expeditions in search of hop strains growing in the wild were undertaken in the Carpathian region of the USSR.

In another area--that is, within the framework of progressive technology of agricultural cultivation under irrigation, improvement was achieved in the cultivation of winter wheat, alfalfa and soy beans; irrigation methods were improved and also methods of using irrigation water more economically. At the same time the system of basic and soil cultivation prior to sowing were completed, planned levels of yields and needed amount of industrial fertilizers were made more precise and recommendations were issued as to the most favorable times and methods of their application, thus increasing the advantage of using fertilizers.

Also, within the cooperative framework, joint field trials were undertaken in breeding high yielding varieties of singly germinating sugar beets, and several singly germinating specimens were sown for cross breeding. The nurserymen carried out crossbreeding of 5 Soviet singly germinating strains with Dobrovieka C, Dobrovicka, N, Wonhanka and with 2 tetraploidal pollinators. Thus 25 combinations were obtained. One singly germinating strain which was pollen sterile was crossed with a multiple germinating pollinator, which was resistant to cirhospores.

An extensive exchange of breeding materials took place in agrotechnology and in fruit breeding; also preparations were made to establish an orchard in USSR which would be planted to varieties resulting from Moldavian and Czech breeding experiments; each to be on a area of 0.5-1.0 hectare (apricots, plums, etc). The same varieties will be planted in South Moravia, CSSR. The basic aim of this cooperation is the cultivation of new varieties, adjusted to local conditions, which are more frost resistant, disease resistant and produce better tasting fruit. The best selected varieties are now being checked.

Interesting results were obtained in developing varieties of apricots for rootstock. Four types were cultivated which are highly frost resistant and high yielding with high percentage of germination (up to 95%) free of viruses and easily grafted. Two varieties of English walnuts, Apolo and Jupiter, were grown which were distinguished by early fruit production, high frost resistance, self-pollination and high yield. In agreement with a

previous plan USSR is testing a special Czechoslovak prophylactic program to protect fruit trees against viral diseases.

Technical Development in Animal Production

We must single out the highly effective cooperation in the area of animal production, where, due to sharing of work among scientific research organizations it was possible to solve the problem of constructing progressive types of industrial poultry complexes. A joint experimental technical project was worked out for a complex built for fattening 500,000 geese, which would eventually result in construction of such a complex in both countries. At this time construction of the first segment of this complex has been started in the USSR in the Kokcheta collective, and in CSSR in Dunajska Streda and in Michalovce. Effective joint cooperation of Czechoslovak and Soviet specialists made possible the creation of such a project in a relatively short time, which corresponded to modern needs, demands for a greater level of mechanization and automation of the production process with high economic parameters. Thus in Czechoslovak-Soviet scientific and technical cooperation it has been possible to bridge over the difficulties connected with the fattening of geese on an industrial scale.

The next experimental technical project to be worked out was a poultry house equipped with cages, which could accommodate 500,000 turkeys annually, as well as a project for constructing a set-up for producing 3 thousand tons of turkeys fattened for slaughter and kept on floors covered with grates. In the CSSR this will be built in the Zvolen district and in the USSR an appropriate location of the project is at present being selected.

Construction of the above-mentioned complexes will enable both countries to thoroughly study their experiences, prepare concrete recommendations and utilize them in working out modern prototypes of similar projects.

Further cooperation was aimed at working out methods of disinfection and the handling of manure on large mechanized farms. Three different schemes were worked out to provide technical solutions for the handling of manure. The first two involved a system of dividing the manure into liquid and solid and using the solid as fertilizer and the liquid as waste. This was successfully tested in the CSSR and an experimental set-up to handle this is being planned in pig raising complexes of Agropodnik Hodonin and of Masospol Opava. The third scheme is a system of leaving the manure in decaying chambers--thus obtaining biogases to be used as heating fuel and using the solid and liquid parts as fertilizer. This is now being tested in the CSSR. This particular scientific and technical cooperation is based on the principle of mutual division of labor. For example, the Soviet Union has made available to the Czechoslovak specialists experimental results which involved removal of manure by washing it away. By making use of their experiences, and after judging them on the basis of technical possibility in the CSSR, it became possible to halt Czechoslovak research efforts aimed at solving these very problems.

A filtration centrifuge was used in the USSR after the separation of manure. This has been given to Czechoslovakia and is now being tested. In the meantime CSSR offered the Soviet institute their method of "fertilizing with liquid pig manure." Collaboration has been successful in this area from the beginning and is mutually advantageous. Predetermined division of work removed the possibility of duplication in solving some of the problems, thus resulting in financial savings.

Common Problem Areas Are Becoming Broader and Deeper

In addition to mutual exchange of specialists in solving problems decided upon long ago, several consultations took place at which questions of future agricultural research were studied and an exchange of documentation, projects and some technology was undertaken. This form of cooperation contributes significantly to broadening the knowledge of both countries.

During mutual exchanges by specialists new areas for effective cooperation are constantly being discovered. In addition, new proposals also emerge from the regular meetings by the highest representatives of agriculture of both countries. One such proposal, for example, concerned the hydro-thermo-pressure method of processing straw into feed, new method for long term preservation of feed on a biological basis, a possibility of cultivating varieties of plants which have only lately been found to have significant industrial potential or use as feed be it for animals or for people. Another proposal was the utilization of further, new sources of non-traditional raw materials for these purposes.

Needless to say, even in this unambiguous effective cooperation there are further possibilities of increasing its scope. The second half of the years 1976-1980 was marked by concentrating efforts on the one hand on selection of the most important themes for scientific and technical cooperation, in the coming years 1981-1985, which would produce desires results in both countries, and on the other hand to utilize such forms of cooperation which would speed up solutions and improve their quality.

A series of scientific research themes from the period 1976 to 1980 have continued on into 1981-1985. Also both temporary international collectives will be continued and will continue to solve problems involving cultivation, harvesting, post-harvest handling and breeding of new varieties of hops, with potential yields of 2500-3000 kg per hectare. A number of up to date poultry complexes will be produced using industrial technology, and after these experiments are verified, model projects will be constructed. Along with developing and introducing effective methods for removing, processing and using liquid manure in pig farms--techniques for handling liquid manure with a 92-94% moisture content, and manure water with a moisture content of 95-98% will be tested, as well as their potential use as fertilizer. The problem of constructing a technically satisfactory set up for handling liquid manure and manure water will be finally resolved and an operational system will be worked out.

Solution of problems of agrotechnology and fruit culture breeding will lead into the development of technology of apricot production using complex mechanization. Also it will facilitate working out and checking consistent methods for primary varietal experiments and fruit breeding, and a development of methods for obtaining virus-free fruit clones.

Breeding and creation of new varieties of winter wheat and of barley are based on combined breeding of varieties of winter wheat with potential yields of 8-9 tons per hectare, marked with considerable cold resistance, good quality of grain, resistance to flatting and to fungal diseases; also varieties of barley with potential per hectare yield of 6-7 tons, marked with high drought resistance, resistance to flattening and to fungal diseases and with high technological quality of the grain.

In addition to all these themes the scientific and technical organizations are collaborating to improve the technology of preparing and storing cattle feed, where the primary goal is to substantially decrease nutrient losses, and to activate long term storage of feed while maintaining all its important nutritional properties.

Further cooperation is aimed at creating high yielding varieties of flax, with high fiber quality, short growing period, resistance to flattening and diseases, and improved cultivation techniques. For this purpose experimental set ups will be constructed for forming the raw material into large bales. Problems concerning conservation of moist flax stalks will be addressed and solved.

In breeding and seed culture of new varieties of legumes and in the agro-technology of their cultivation cooperation will be aimed at breeding new legume varieties suitable to growing conditions of both countries; cooperation will also be aimed at breeding varieties of lupine suitable for feed, with an average size grain, and yielding 3 tons per hectare, containing a minimum of 38 percent protein, without any alkaloids, with a shorter growing period and with an even flowering on both the side branches and the main stem. In agrotechnology new methods will be worked out for the cultivation of new varieties of white lupine, of soy beans, peas and beans for feed. In order to use the new irrigation technology in corn cultivation, corn will be specially bred and the highest yielding varieties and hybrids will be the ones used to increase per hectare yields in irrigated experiments.

Tests of new efficient machines and adapters for soil cultivation, harvesting and post-harvest handling of grain and of green fodder will be undertaken, with the aim of reducing losses as much as possible. At the same time irrigation techniques will be improved.

Scientific research organizations of both countries will also collaborate in solving two tasks flowing out of the "comprehensive program of scientific and technical cooperation between the CSSR and the USSR in the area of the use of biochemistry and chemistry in agricultural production, during the period 1981-1985." The main stress will be an attempt to make more precise minimum requirements and norms for vitamins, trace elements and aminoacids

for domestic animals, and also to obtain veterinary and health evaluation of stable grain forms of vitamins A, D_3 and E, which can be used as feed.

Cooperation Is a Permanent Interest In the Agricultural Sector

In addition to all of the above, cooperation will also be aimed toward exchanging and introducing technology of cultivation of selected types of field crops. It is assumed that this will help accelerate the introduction of modern cultivation technology into agricultural production.

These questions were scrutinized at the last meeting of the agricultural sector representatives of CSSR and USSR in January of 1982 in Moscow. Among other matters, for example, they decided on cooperation aimed at supplying agricultural concerns of both states with alfalfa plantings. They also decided that in 1982 they will exchange experiences with alfalfa cultivation in agricultural concerns of the Dniepropetrovsk oblast, covering an area of 500 hectares, where they will utilize Czechoslovak technology and invite participation of Czechoslovak specialists. At the same time necessary quantities of seed, of chemicals and other material technical means will be delivered. Also in the USSR they will be testing the possibility of introducing alfalfa seed production, based on the CSSR technology, in the Uzbek SSR and other "oblasts" of the USSR, where climatic conditions will be naturally advantageous for the cultivation of this important crop.

One of the priority problems is the solution to the question of how to introduce results obtained in agricultural research into practical production. It was decided that during 1982 there would be a bilateral meeting of specialists and experts on this subject and combined proposals to improve the system will be worked out. The question of introducing the research results into production emerge also from scientific and technical cooperation between member nations of the Warsaw Pact; therefore bilateral meetings between CSSR and USSR specialists would be a very important contribution toward solving this very important problem.

In addition there will be cooperation in judging the present state of personnel and of agricultural services, from the standpoint of their economic effectiveness and efficiency and with the intent of improving them.

Utilization of new effective forms of cooperative, such as cooperative solution of research problems based expressly on division of labor, or common solutions resulting from establishing temporary international collectives--all these were major aims of both countries. The period 1981-1985 will be marked by transition from previous scientific and technical cooperation into these more tangible forms. At the same time solutions will be aimed primarily to approaches which will be common to both countries, thus ensuring effective collaboration. Even when we introduce results of research into production, if that research had been based on only our own efforts, introduction would necessarily be delayed--while collaboration between the two countries will help a great deal.

Prior division of scientific research work among scientific research organizations of CSSR and USSR, which up till now has been carried out according to a work plan, will be formalized in the next 7-year period in form of a agreement. A number of agreements will be signed concerning cooperative problem solving which will designate more precisely terms and tasks of the partner organizations and which will further enhance the continuity of the collaboration. In addition to the two established temporary collectives for solving the problems of hops, there has been discussion of signing an agreement for another temporary collective, this one to be concerned with the problem of conserving the moist stems of flax.

The subject of the yearly meeting of the agricultural sector representatives of both countries will be the course of future cooperation, results to be achieved and further scientific and technical improvements. Certain common tasks for the near future have been singled out, which will be carried within the meaning of the directive of the 16th CPSU Congress and the 16th CPCZ Congress and are expected to be completed within a year. It is in the interest of all participants in Czechoslovak-Soviet scientific and technical cooperation that the development of agriculture should be ever more dynamic and should thus ensure the nourishment of the inhabitants of both our socialist lands.

This cooperative article is also appearing in Russian in the all-union monthly called "Ekonomika selskovo khozyaistva."

5478
CSO: 2400/62

PRODUCTION, EXPORT OF EC 1055 COMPUTERS REPORTED

First EC 1055 in Magdeburg

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 16 No 11, Nov 79 p 29

[Article by Dieter Buttgereit: "EC 1055 in the VEB Magdeburg Data Processing Center"]

[Excerpts] On the eve of the 30th anniversary of the founding of the GDR, the first computer of the ESER II (RYAD II) series, the EC 1055 was put into operation in the Magdeburg data processing center.

In Magdeburg Bezirk, plans are to create, with the help of a widely branched data teleprocessing network, direct access of many users to the central computer of the data processing center (EC 1055). The Robotron 4230 data collection system, which is to be installed at a later date, will substantially increase efficiency.

Academy of Sciences Computer

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 8, Aug 80 p 2

[Unattributed report: "EC 1055 at the GDR Academy of Sciences (AdW)"]

[Text] An EC 1055 computer was delivered to the Center for Computer Technology of the GDR Academy of Sciences in late May 1980. With this installation it will be possible to introduce new, more effective ways to use computers in research.

Installation in Schwerin

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 12, Dec 80 p 2

[Unattributed report: "Installation in Record Time"]

[Text] In the record time of only 15 days an EC 1055 was installed and put into operation in the Schwerin Data Processing Center.

Installation in Neustadt

Dresden SAECHSISCHE ZEITUNG in German 11 Apr 81 p 2

[Excerpts] (Neustadt) Three months ahead of schedule the Robotron combine delivered a modern EC 1055 electronic data processing system to the Fortschritt Agricultural Machinery Combine. As a joint party congress project for the two combines, use of the ESER computer was turned over to the youth of the computer center in Neustadt as their project by Dr Thieme, director of the Fortschritt combine.

First EC 1055 to USSR

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 2, Feb 80 p 3

[Unattributed report: "First EC 1055 Punctually Delivered to the Users"]

[Text] The first installations of the new EC 1055 data processing system were delivered to the partners in the Soviet Union in late 1979 by the VEB Robotron Electronics in Dresden. In mid-1979 the collective had started series production of the central unit 3 months ahead of schedule. With the punctual delivery of the systems the working population wants to contribute to integration and closer cooperation. The Robotron collectives in Dresden have met their plan targets for over 70 months.

Export for USSR Power Grid

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 6, Jun 80 p 2

[Unattributed report: "EC 1055 for Northwest Soviet Republics' Power Supply System"]

[Text] An EC 1055 from the Robotron combine was delivered in Riga to the dispatching administration of the North-West Associated Power System. North-West unites the electric power networks of the Belorussian, Estonian, Latvian and Lithuanian SSR and those of Leningrad, Karelia, the peninsula of Kola and Kaliningrad. This power system, which is controlled by the Riga dispatch center, secures the power supply for the industrial centers in the northwestern USSR. The EC 1055 is to contribute to a more flexible control of the power system, where for 4 years a small Robotron 1840 computer has already been in use.

Computer for Belorussian SSR

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 7, Jul 81 p 3

[Unattributed report: "EC 1055 for Belorussian Economy"]

[Text] In Minsk an EC 1055 was delivered to the Soviet user on the occasion of a technical exhibit presented by the Robotron Export-Import foreign trade

enterprise. It will be used in the Niwa scientific production association which develops automated management systems for Belorussian agriculture. This computer is the 25th EC 1055 exported from the GDR to the USSR. The Robotron combine has delivered approximately 150 electronic data processing machines to the Soviet Union.

Twenty-six EC 1055's for USSR

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 9, Sep 81 p 3

[Unattributed report: "Twenty-six EC 1055 Computers Delivered to USSR in the First Half of 1981"]

[Excerpt] These Robotron ESER computer systems will be put into operation at the USSR Academy of Sciences, in the finance and transportation fields, in the petroleum industry, in the Kama Truck Factory, and in the Togliatti Automobile Factory. The computers will be linked to Bulgarian and Soviet disk storages, Czechoslovak printers, graphic output machines and peripheral equipment from other countries.

Fiftieth EC 1055 for USSR

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 12, Dec 81 p 2

[Unattributed report: "EC 1055 Delivered to the USSR"]

[Text] In late October 1981, an EC 1055 was delivered to the information center of the USSR State Committee for Science and Technology by Prof Dr Wolfgang Sieber, general director of the Robotron combine. This is the 50th computer of this type that the Dresden combine has exported to the Soviet Union.

The first EC 1055 was put into operation in the spring of 1980 in a power distribution system. More computer systems are located in Moscow institutes, in the Togliatti Automobile Factory and in the Ministry of Petroleum. The information center of the State Committee for Science and Technology has been using an EC 1040 and an EC 1055 for some time. At the information center, data are stored and processed in such volume that the use of modern computer technology is indispensable.

Computer for CSSR Coal Industry

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 5, May 80 p 2

[Unattributed report: "Robotron Computer Technology Successful in Czechoslovak Economy"]

[Excerpt] In late March, the "Robotron 80" technology exposition was held in Bratislava where the GDR Robotron combine introduced the 1980 production assortment, including the modern EC 1055 computer. The first unit of this type for Czechoslovakia will be installed in an enterprise in the Ostrava-Karvina coal district. Included among the exhibits is the 4230 data collection system. Three of these systems are presently being tested in Czechoslovak enterprises.

Planned Export to Czechoslovakia

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 8, Aug 81 p 3

[Unattributed report: "Prague 'Buefa 81" Exhibits GDR Computers"]

[Excerpt] In late May 1981 the "buefa 81" Robotron technical exposition was opened in Prague. It presented such office equipment as the computer family A 5100, component assemblies, microcomputer and graphic output equipment [Reisszeichentechnik]. At a press conference it was reported that the CSSR currently is using Robotron systems valued at approximately 3 million korunas, including 50 ESER EC 1040 computers. In the past year alone the GDR and the CSSR exchanged products of this sort valued at almost 1 million korunas. Two EC 1055 systems have been put into operation; Robotron will deliver a total of 25 of these computers to Czechoslovak customers by 1985. In 1981 the State Savings Bank of Prague, the Skoda factories in Plzen and the Slovnaft chemical combine in Bratislava will be provided with EC 1055's.

The GDR, on the other hand, has been importing reliable computer equipment from the Zbrojovka firm for years. Marketing of complete CSSR computer systems will start in the GDR in 1981. After the USSR, the CSSR is the most important socialist export partner of Robotron.

Computer for Prague Bank

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 19 No 6, Jun 82 p 3

[Unattributed report: "EC 1055 in CSSR Bank"]

[Text] In April 1982 VEB Robotron Combine placed a new EC 1055 computer at the disposal of the Prague municipal state savings bank. With the help of this computer the Prague financial and credit institution will at first collect data on some 180,000 checking, salary and savings accounts; it will gradually expand this number to include the entire Czech Socialist Republic, for which this state savings bank is responsible. Two years ago the Robotron combine installed the first EC 1055 in the CSSR in the Ostrava-Karvina coal district. Another of these computers is currently being installed in the Skoda works in Plzen.

Exports to Hungary

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 11, Nov 80 p 3

[Unattributed report: "Robotron Computer Technology Successful in Hungary"]

[Text] Three EC 1055 computers will begin operation in Budapest this year: one at the insurance company, which also uses smaller computers from Robotron for rationalization purposes, and the other two at the Ministry for Machine Building and in the Noto (National Organization for the Technical Servicing of Computers) office of the Hungarian center for the service of ESER (RYAD) and SKR (system of small computers) equipment. Robotron computers have been

operating successfully for 6 years in Hungary. This equipment includes 19 EC 1040 computers in Hungarian factories and institutions, along with thousands of accounting machines, data collection machines, and small computers exported to Hungary annually.

The entire optimization of transportation of the Hungarian State Railways (MAV) is done on an EC 1040. In the Csepel Automobile Factory a GDR computer is helping with the restructuring of the production process and the rationalization of operational procedures, and in the Hungarian petroleum enterprise an EC 1040 serves as the "electronic grid" for recording all the data gathered in geological reconnaissance. A Robotron computer in the energy institute of the Ministry for Heavy Industry, is proving highly useful for the planning and calculation of the economic benefits of the energy savings program.

Romania Receives First EC 1055

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 19 No 5, May 82 p 3

[Unattributed report: "EC 1055 for Romania"]

[Text] An EC 1055 data processing system with a storage capacity of 2048 K bytes was delivered to Romania in mid-March by representatives of the Robotron combine and the appropriate GDR export firm. This is the first system of this type that has been delivered to Romania.

The GDR and Romania have long had a strong relationship. For many years the GDR delivered punched card technology to Romania; this equipment was then replaced by electronic data collection machines. These are already being used in many Romanian finished products.

CSO: 2302/5

BRIEFS

EC 1055M COUPLING FOR DUBNA--In 1981 the producers of computers and typing equipment in the GDR have achieved remarkable results. Commodity production rose to 117 percent compared to 1980, and labor productivity rose to 116 percent. Exports to the USSR rose to 136 percent compared to 1980. The installation of a coupling of two EC 1055M computers in the Dubna Nuclear Institute, planned for the anniversary of the October Revolution, is an exceptional scientific-technical achievement. A model of this coupling will be shown at the 1982 Leipzig Spring Fair. [East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 19 No 4, Apr 82 p 2]

CNC 600 IN SERIES PRODUCTION--Series production of the newly developed microelectronic CNC 600 machine-tool control has started in the VEB Karl Marx Numerik enterprise. This product represents the first time in the GDR that a control has been developed and built on the basis of microelectronics. Compared to conventional technology, these computer-controlled machines permit a doubling of productivity. The programming effort is lowered by almost 75 percent and the processing time is reduced on the average by 10 percent. The control is used in individual machines and in complete processing centers. [East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 17 No 3, Mar 80 pp 2-3]

CNC 600-1 SERIES PRODUCTION--(Karl-Marx-Stadt)--A new microelectronic control, the CNC 600-1, has been put into series production in the VEB Karl Marx Numerik enterprise. The new control represents improved performance over the known CNC 600, especially with regard to expanded range of appl' ation. [East Berlin NEUES DEUTSCHLAND in German 12 Jul 82 p 3]

COMPUTER-CONTROLLED WELDING INSTALLATION--The first GDR electron beam welding installation controlled by a microcomputer was put into operation on 13 July 1982 in the ZIS (Central Institute for Welding Technology) in Halle. The ESA 150 MR installation was developed by the Manfred von Ardenne Research Institute in Dresden. The microcomputer control and programs originated in the ZIS Halle. The new installation is the most highly productive of its type in the GDR and can accommodate steel prices of 60-80 millimeters for welding. [East Berlin NEUES DEUTSCHLAND in German 14 Jul 82 p 1]

CSO: 2302/7

LATEST DEVELOPMENTS IN NUCLEAR MEDICINE

Bucharest FLACARA in Romanian 4 Jun 82 p 22

/Interview with Tiberiu Pop, doctor of medical sciences, chielf of Nuclear Medical Unit at Bucharest Panduri Clinic, member or honorary member of several societies for nuclear medicine or ultrasonics in the United States, Belgium, Italy, Sweden etc., member of European Society for Nuclear Medicine, author of more than 250 scientific papers published in Romania and abroad, sole or joint author of many books including "Pulmonary Scintigraphy," Medical Publishing House, 1971, "Nuclear Medicine in Athletics," Sport-Tourism Publishing House, 1974, "Nuclear Medicine in Clinical Diagnosis," Military Publishing House, 1979 and "Ultrasonic Diagnosis," Medical Publishing House, 1982, and laureate of the Romanian Academy's Victor Babes Prize for 1979, by Ovidiu Ioanitoaia/

/Text/ /Question/ Strictly speaking, Dr Pop, just what is nuclear medicine?

/Answer/ To put it briefly, it is a new branch of medicine dealing with isotopes and ultrasonic waves. This young branch developed as a logical consequence of the information "explosion" and it has been gaining ground for the very simple reason that it provides better opportunities for investigating the human organism. Most often nuclear medicine begins when traditional medicine's resources have been exhausted and its limitations have to be recognized. Let us make one thing clear. Nuclear medicine has never been intended to replace traditional medicine. That would be patently absurd. It merely supplements and intensifies it.

/Question/ How?

/Answer/ It is the starting point of some new approaches to treatment of the patient, being the most graphic example of an interdisciplinary science resulting from combining some fields of physics, chemistry and electronics with medicine. Furthermore, by its diagnostic methods, whether they are radioisotopic or ultrasonic, it reduces two basic aspects of one biological process, namely the concepts of structure and function, to the same common denominator. The recent progress made both in equipment and in radiopharmaceutical agents has broadened, intensified and diversified the field of application of nuclear medicine, and cardiovascular nuclear medicine, urological nuclear medicine, gynecological nuclear medicine etc. are referred to more and more often today as distinct specialties.

/Question/ Let us say we understand that. But there is still need of some further explanation. What are the advantages to nuclear medicine's methods of investigation?

/Answer/ First, they provide information unavailable by ordinary methods. Nuclear medicine penetrates the organism in depth.

/Question/ Just a minute. Give us an example.

/Answer/ Radioimmunology, for example, has emerged as a subbranch and has succeeded in identifying hormones and enzymes like the parathyroid hormone or serous calcitonine that are impossible to detect by other means. As another example, diagnosis of the prostate has been refined by scintigraphy with Extracyt marked with Iodine 131, an invention patented by Ioan Galateanu and Tiberiu Pop. It is called a "Process for Scintigraphic Vizualization of the Prostate Gland" and bears the number 63,398, dated 19 April 1978. Of course the main ailments of the prostate are adenoma and cancer, but they are rather difficult to detect by traditional methods. What did we accomplish? We expedited treatment by identifying them scintigraphically. In general the methods of nuclear medicine, especially, ultrasonics, have several definite advantages. They are harmless, convenient, rapid and precise.

/Question/ If you say so. You are better able to say. But doesn't the very term nuclear medicine alarm you? Don't the technique and equipment involve risks?

/Answer/ Risks? There is no question of that. It is a prejudice! Let us discuss it. You will agree no method of investigation is infallible. Every method has some defect and can be improved. The most modern ones like cardiac catheterization or arteriography provide very valuable data to be sure, but they subject the organism to traumas and also involve a modicum of risk. They are, in medical terminology, invasive. Nuclear methods are not. Take echography for example, diagnosis with ultrasonic waves, a veritable miracle of the last decade and a method recognized for its clinical applications. Do you know about it?

/Question/ A little. Bats guide themselves in flight and detect obstacles by means of ultrasonic waves, do they not?

/Answer/ Yes, the principle is largely the same. But I repeat the method is distinguished by exceptional qualities. It can be said of it that it not only has been developed but it has invaded contemporary medicine. It is harmless, in the first place. No substance is introduced into the organism and there is no risk of irradiation.

/Question/ Very good, but what does the examination consist of?

/Answer/ The transducer, a kinf of electrode, is placed on the skin. It produces ultrasonic waves that are reflected upon impact with the issues and appear on a screen in the form of electric impulses. And finally, not to burden you with details, a kind of map of the respective tissue is obtained, that is information about the state of its health. In the second place, the method is also convenient because the patient needs no preparation of any kind before the examination.

/Question/ And in the third and fourth places?

/Answer/ It is of course very accurate, with no possibility of errors in the equipment. It is also very rapid, as the results appear on the screen at once.

/Question/ As far as we know, doctor, your unit, a methodological authority on nuclear medicine, made the first computerized echograph in the world. Tell us about it.

/Answer/ The unit, founded 20 years ago, is equipped without exaggeration on the highest level. If I do say so we have the most modern equipment in the world at Panduri, and I stress the point that it is concentrated under the same roof. Why do I stress it? Because in other countries nuclear medicine has been dispersed or is about to be dispersed, every discipline, endocrinology, gynecology etc. having its own echographic service.

/Question/ What is wrong with that?

/Answer/ The information is also inevitably dispersed, and I say that is bad. Corroboration of the data from the equipment is obligatory and also decisive. Diseases affecting one organ alone are increasingly rare today. Rather they affect the whole organism, and therefore the data should be analyzed according to a uniform conception.

/Question/ By the way, how was all this highly sophisticated equipment procured?

/Answer/ The party and state have been supporting development of nuclear medicine in every way, and we have received considerable funds for the purpose. And in view of the specializations we have brought about under UN sponsorship in several countries (Sweden, Italy, the Netherlands, the USSR, Austria, the United States, Canada, England etc.), we persuaded both the International Atomic Energy Agency and the UN Program for Development to provide us with technical aid and experts. The unit in which I work and where I hope I have succeeded in forming and consolidating a fine team of specialists was visited among others by the famous professors John Morris of Sydney and Will Nelb of Seattle. They were favorably impressed with the progress made, even acknowledging that in some areas we Romanians are ahead of everybody. A proof? The very computerized ecograph you mentioned, the first one of them in the world. It was presented at some major congresses in Cologne and Vienna in October 1981 and May 1982 respectively. The interest aroused by this Romanian first was extraordinary.

/Question/ Doctor, isn't all this equipment remote from a patient?

/Answer/ No. Nuclear medicine is not exclusivist and it knows that the world did not begin and end with ultrasonic waves. Its examinations are conducted in connection with the clinic and the observation sheet is law. Nor does it discredit an analysis but rather selects a given method, one way or another, according to the clinical signs. But admittedly there is a risk that can come from complete ignorance of the equipment. Theoretically speaking it can go astray if uncontrolled, so that every unit needs highly qualified personnel. Panduri is exemplary in this respect, since the biologist Elisei Petcu, the radiochemist Doinita Dumitrache, the electronics expert Pavel Horoziu and the physicist Emil Toroiman are top-flight professionals with sound backgrounds.

/Question/ One more incidental question: Who trains these personnel, and when and where?

/Answer/ As I was saying, nuclear medicine is expanding rapidly. There are 27 or 28 units in Romania but the personnel problem is still unsolved. The unit heads must be certified by the IFA /Institute of Atomic Physics/, but the courses have been limited to a few months. In this connection I must say that there has been a Romanian society for nuclear medicine for 7 or 8 years, but it is mostly in name only and it does no actual work. I think the time has come to join all forces in this sector, for the benefit of the patients of course. Unfortunately a number of physicians are ignorantly fostering the prejudice that echography is hazardous, that it irradiates, that it endangers lives, etc. It is a mistaken and unscientific conception. Moreover one of our finest internists, Reader Benedict Gheorghescu at Fundeni, is one of the pioneers of Romanian nuclear medicine along with Gheorghe Jovin. And in view of the way a great many strong nuclear medical units are operating, at the Institute of Endocrinology, at the Brancoveni Hospital, and at the oncological institutes in Iasi, Cluj-Napoca, Timisoara, Baia Mare, Tirgu Mures etc., etc., their efforts would be better channeled. An active society would solve the problem to a great extent.

/Question/ Perhaps that is the most important concern of the specialists in nuclear medicine. What do you think?

/Answer/ What more could I do?

/Question/ I don't mean you. You have done enough, haven't you? By writing the books you have written, which are highly esteemed at home and abroad, you have opened up a path and it is the task of the competent ministry to continue it. In another connection, how available is the medicine you practice to the great mass of patients?

/Answer/ Now why shouldn't it be? Patients come here mainly from the Panduri Hospital but also from all the other affiliated units, or distributed units to use the correct term. Actually they come from all over the country, for when it is a question of a man's health don't you forget whether it is distributed or not when you go into the consulting room. To do otherwise would unquestionably be a most serious error.

/Question/ How expensive is a nuclear medical diagnosis?

/Answer/ It is not expensive and furthermore some of the data it provides are not available in any other way. It is an old saying that health is beyond price. At any rate it is all free of charge to the patient. But no' all physicians know about it! I don't think 3 percent of my colleagues know exactly what an echograph means! I give some of them the extremely sophisticated and also extremely valuable results, they thank me and, lowering their voices, they ask me to explain them in their language! But nuclear medicine has only one language, and no other has yet been invented.

/Question/ We understand the diagnosis, and it is clear. How about the treatment?

/Answer/ Nuclear medicine has also been opening new windows on treatment. Radioactive iodine is unbeatable for thyroid cancer. Cancer of the urinary bladder, polycythemia vera, dermatoses etc. are also being treated. Problems of dosing are most certainly within the competence of nuclear medicine, it is sufficient to say. And there are its applications to spectator sports. We have been collaborating for many years with the Center for Sports Medicine and, I permit myself to judge, the results are noteworthy both in dosing those exerting effort and, more particularly in recoveries from injuries. Several soccer players (Iordanescu and Iordache as I recall now), a number of athletes (Natalia Marasescu, Carol Corbu and the swimmer Cristina Balaban), and other top performers have benefited by nuclear medical care and have been cured rapidly. But our branch is not a panacea. It repels nothing and removes nothing, it only supplements and intensifies. Let us consider, in passing, the medicinal plants. Of course they have no bearing on what we are doing, but that does not mean we ignore or look down upon that ancient and inexhaustible source of health. Wasn't it Heraclitus who said "Nature is the best physician"? As a personal opinion, I would even be tempted to say that not everything has been done to exploit the plants. On the health front the medicine we are practicing is a redoubtable and effective weapon, but it is not the only one for all the fact that it is the most modern and sophisticated one and it uses computers. While knowing its virtues we also accept its limitations.

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END

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SCIENTIFIC AFFAIRS

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ACHIEVEMENTS OF SCIENTIST IN PHOTOPROCESS DEVELOPMENT EXAMINED

Sofia TEKHNICHESKO DELO in Bulgarian 3 Jul 82 p 12

[Article by Vasil Simeonov: "Symmetry of the Photoprocess"]

[Text] Experimental and theoretical workers were pleased by the theory of the mechanism of the photographic process suggested by the two famous physicists Gurney and Mott in 1938. The acceptance of their theory was not guaranteed merely by their reputation but was supported by a number of experimental proofs. The strange and unique process in the silver halogens became more clearly understood and accessible. Previously, assumptions, guesses and hypotheses had been formulated, but the painful question remained: Why was it that only silver salts could turn into a hidden image if exposed to light, an image which became visible after development? Since they were not the only compounds reacting to light, why only they and not all?

As we know, a photographic emulsion consists of minute crystals of silver bromide dispersed in gelatin. However, in order to study the mechanism of the photographic process large silver bromide crystals must be used. Here is what Gurney and Mott had discovered: When a silver bromide crystal is exposed to light the light quantum removes an electron from the bromide anion (known as photoelectron). It moves around the crystal, drops into one of its imperfect areas -- cracks or twists in the proper structure -- and can remain there for a while. However, since its charge is negative, it draws to itself silver ions, particularly those which have left their proper place and have settled between junctions. The meeting of the electron with the positive ion yields an atom of silver, which is a structural particle of the so-called hidden image. Several of these atoms can be developed and form a visible image, which is the purpose of the photographer. The theory provided an excellent explanation of a number of photographic effects and no one was impressed by the fact that it was not quite symmetrical.

At that time Yordan Malinovski had not yet earned his present academic titles and distinctions, such as BAN [Bulgarian Academy of Sciences] corresponding member, professor, doctor of chemical sciences, Dimitrov Prise winner, honorary member of the Royal Photographic Society, director of the Central Laboratory for Photographic Processes of the BAN, etc. He was a follower of the famous Bulgarian scientific school -- the school of physical chemistry -- headed by Academician R. Kaishev. He was also stubborn. He became interested in the subject and undertook to study it independently. What happens to

the particle from which an electron has been removed? The rather clumsy name under which it is know in Bulgarian is photohole! It should have a positive charge (the electron having taken with it the negative charge, the remainder becomes positive) and should be able "to accomplish" a number of things, such as, for example, to regain its electron instead of letting it form silver atoms and, being simply a bromine atom, could have a destructive effect on the silver compounds, since bromine and silver react easily. However, no such thing develops in practice, for which reason it is accepted that this photohole plays no role in the photoprocess.

Yordan Malinovski's view is somewhat different. If the photohole plays no role it means that it is either slow moving (does not move in the crystal) or else that it exists for a very short time. Was this the case? The original method developed for detecting and determining the parameters of photoholes is already know as the method of Malinovski and his associates. What was more important however, was that contrary to the expectations of the theoreticians, who had neglected the holes, they proved to be both mobile and viable. Consequently, the actual photoemulsions create conditions which remove them from the process of formation of the latent image. However, to ignore their significance means to violate the symmetry of the process!

Yes, Yordan Malinovski was convinced that there must be symmetry. Therefore, when photoelectrons are neutralized so should photoholes. This marked the start of the hard road to supplementing and broadening a generally accepted theory. How are the holes "trapped," thus providing a "terrain" for the electrons and the silver ions, which enables them to form a latent (hidden) image? The most attractive theory would be for the holes to become linked with negative-charge vacancies (areas in the crystal grid left behind after the silver ion has left, as it is positive and consequently leaves behind a negative charge). This would make everything quite symmetrical. However, the existence of such a combination was not proved experimentally, although it was possible on the basis of most general logical considerations and, naturally, the experimental data on the nature of the photoholes!

Yordan Malinovski was able to prove the symmetrical nature of the photoprocess. Real crystals always include admixtures of copper or iron atoms, for example. We know that they participate in the oxidation and reduction processes related to losing or gaining electrons. Quite likely, these admixtures were "traps" for the holes. Consider a copper ion which becomes linked with a hole. The result is a copper ion with a higher positive valence. The same applies to the iron ion. The resulting ions, which carry an additional positive charge from the "trapped" photohole, can easily trap a negatively charged vacancy. This assumption perfectly fits with experimental results. The pattern followed by the photoprocess becomes symmetrical -- the photoelectron is trapped and neutralized by the silver ions. The photohole is also trapped with the help of admixtures, which are always present in real crystals, and is then neutralized by the vacancy of the moving silver ion! This represent the full symmetrical system. It explains why the very pure silver bromide monocrystals are virtually insensitive to light. The electron and the hole recombine before moving along their symmetrical paths, leading, in the final account, to the developed image.

One last question remained: Would the admixtures capable of retaining the holes not come to an end after a while? Once again Y. Malinovski proved that the complex between the admixture and the hole becomes diffused along the surface and breaks down releasing the hole (which is chemically the equivalent of active bromine). This special situation on the surface of the crystal has been proved with original and universally aknowledged experiments. However, everything so far defines only one aspect of the achievement -- its theoretical part, the play of a logical mind, confirmed through the dexterity of the experimenter. Studies indicated that the photoholes can play a special role in the photoprocess, both active and independent. If a layer of silver, which can be developed, is deposited on the surface of the crystal, after the exposure it will be reached by holes which will react with the silver. The result of the development is a positive print of the original. This leads to "hole photography" (a new type photosystem) and the conclusion that other light-sensitive compounds can produce an image with the help of photoholes. This marked the beginning of a new direction in theoretical and practical photography.

Today the photographic world is speaking of a symmetrical system and every specialist knows that it is owed to the Bulgarian specialist Yordan Malinovski. The path which lead to it proved that scientific gaps exist even in the most proven theories and most prestigious reputations.

5003
CSO: 2202/14

DEPUTY MINISTER VIEWS CHEMICAL INDUSTRY DEVELOPMENTS

Prague RUDE PRAVO in Czech 25 Jun 82 p 5

[Interview with docent Eng Jiri Marcin, CSc, deputy minister of CSR industry, by Eva Sadilkova; date and place not specified]

[Text] The CSR chemical industry met last year's quotas. In comparison with 1980, it achieved an increase in adjusted value added by 6.8 percent and in profit by 8.4 percent. Productivity of labor in adjusted value added increased by 6.6 percent. The positive fact is that these results were attained owing to a 77 percent saving of material, where in comparison with the previous year there occurred a decrease by 1.35 percent. We asked docent Eng Jiri Marcin, deputy minister of CSR industry, what further tasks are in store for the CSR chemical industry in the current year and the subsequent years of the current five-year plan.

[Question] In what areas are customers for CSR chemical industry products satisfied?

[Answer] We have lately introduced and expanded production of a number of chemical and preparations for the development of animal production, e.g., growth stimulators, a vitamin D2 concentrate, etc. Construction of a large-capacity unit for the production of dicalcium phosphate fodder is underway. For plant production we are preparing herbicides that up to now had to be imported. In 1982 we shall substantially increase deliveries of means for ensiling fodder grasses, we introduced experimental production of the new preparation Silko, etc.

In regards to the machining, electrotechnical and construction industries I consider the decisive contribution of the chemical industry to be the significant increase in the production of basic plastics which made it possible to reduce their importation to one-third of the original volume.

[Question] What, on the other hand, are they not satisfied with?

[Answer] Agricultural personnel are justified in criticizing us, because we still do not satisfactorily meet their demands as to the volume of production.

In some cases they are also not satisfied with the structure of the supplied industrial fertilizers. We implemented a number of measures that will bring about gradual improvement in the quality of fertilizers, but we still will have to concentrate our efforts on this area.

[Question] How about direct deliveries for the consumer goods market?

[Answer] I am convinced that in this regard consumers appreciated ample availability of tires, increased deliveries of goods made of plastics, such as bobsleds for children, 50,000 of which were supplied to sales outlets last year. There is finally no shortage of squeegees for cars, supplies of some photographic materials were significantly increased. Shortages persist in bicycle tires, some products made of molded rubber and inflatable toys. We are dealing in close cooperation with the Association of Slovak Production Cooperatives with increasing deliveries of inexpensive raincoats made of plastics.

[Question] Which sectors of the chemical industry will be accorded priority for their development in the current five-year plan?

[Answer] Mainly production of certain special plastics. Their production will be implemented based on our own research results. It involves, e.g., alkaline polyamide, grafted polypropylene, etc.

On behalf of the electrotechnical industry we envision expanding the production of pure gases, solutions sensitive to light for use in printed circuits, scintillation units, oxygen crystals and sapphire profiles for microelectronics, etc. After completion of the facility in Optimit Odra the rubber industry should achieve a substantial improvement in meeting the demand for molded rubber products, particularly rubber hoses.

[Question] In recent past there was a considerable increase in cooperation between our and the Soviet chemical industry. What is it primarily constituted by?

[Answer] In the current five-year plan the Soviet Union will provide us with, among other things, instrumentation and automated systems for control of technological processes for restructuring 63 enterprises and plants throughout the republic. We want subsequently to export to the USSR, but also to other CEMA countries, more products of higher chemistry, organic pigments, coating materials which make low demands on energy. Conversely, we will import primarily from the Soviet Union products making high demands on energy and, of course, raw materials, mainly crude oil.

Scientific and technical cooperation between our republic and the USSR has also been developing very successfully, after all, it has a long-standing tradition in the chemical sector. Both countries are at the present jointly tackling 47 tasks pertaining to, the production of organic pigments and semifinished products for their production, auxiliary systems for the rubber industry, chemically pure substances, chemical fibers, synthetic minerals, vitreous materials and household chemicals. Some of the solutions

have already produced concrete results. For example, documentation was worked out and experimental pilot production units were set up for producing some of the auxiliary systems for the rubber industry, which will be implemented in the CSSR as specialized production to meet the needs of the Soviet Union and of other socialist countries. Already in the current five-year plan it will be precisely deliveries of these products (antioxidants and plasticizers) that will cover a considerable part of our import needs for products with high energy demands from the Soviet Union.

Similarly developed is also mutual cooperation in the sector of crude oil processing and petrochemistry, wherein 10 tasks are currently dealth with, and in the sector of paper and pulp industry. Herein both countries deal with new methods for production of pulp that would reduce pollution of waste waters and air pollution. Technical and scientific cooperation between the CSSR and USSR is also contributing toward gradual elimination of dependence on importation of some chemical products from nonsocialist countries.

[Question] The chemical fair in Bratislava will open on Saturday. What will enterprises of the CSR chemical industry bring to Incheba 82?

[Answer] At this year's Chemopetrol exposition, customers will get a chance to familiarize themselves with, a new preparation, Gestrofan, for controlling the birth rate of horned cattle and pigs. Another new product is a preparation to be used in the production of automotive gasolines to gradually reduce the lead compound contents. For the driving public there will be car oil, Super-Mogul-Stabil to extend the time between oil change while maintaining good lubricating properties throughout all operations. A new type of mixture and a highly effective fertilizer, Enpekasol, is destined for small growers.

VHJ [economic production unit] Unichem will familiarize customers with a new improved anticorrosive preparation for automobiles. Olachindox, is aimed for agriculture--as a non-antibiotic stimulator to increase animal production. Health personnel will certainly appreciate the set of diagnostic strips, Phan.

A significant contribution made by the chemical industry to the therapy of some oncological diseases is the preparation Platidian-R from Lacheme Brno. All of the mentioned products are already in production. VHJ Czech Rubber and Plastic Plants will exhibit new types of passenger car, truck, tractor and special tires. The clothing industry and its customers will surely appreciate the new type of imitation leather Vinytol, which has improved utilitarian properties and makes a lesser demand on foreign exchange resources for importation of raw materials. The new types of tires and improved types of imitation leather will be introduced into routine production in the latter half of the current year.

8204
CSO: 2404/59

EFFECTS OF CLIMATE, SOIL CONDITIONS ON WHEAT QUALITY ANALYZED

Prague, ROSTLINNA VYROBA in Czech No 2, Feb 82 pp 133-139

[Article by J Prugar and V Hyza:* "Effect of Climate and Soil Conditions on Wheat Quality"]

[Excerpts] The concept of "climate" embraces a variety of different natural factors which affect the biochemistry of wheat in varying degrees. They include moisture, temperature, sunlight, the related factor of soil solution concentrations, and a complex of soil properties created through prolonged interaction between geological and meteorological factors in a given area.

The soil, its structure and its humus and available nutrient content have an extremely important effect on wheat quality. Under given climatic conditions, the condition and composition of the soil have a very fundamental effect on plant biochemistry and on the utlimate composition of the grain. As a result, within a given agricultural organization, a given variety will show considerable differences in quality in locations somewhat distant from each other as a result of differences in soil quality. The soil can do much to make up for unfavorable climatic conditions.

The effect of soil moisture manifests itself in both yield and quality. While moisture during the growth period promotes good development and growth and accordingly high yields, it usually decreases the amounts of nitrogen compounds in the grain and leads to poor results in other quality factors as well.

High environmental moisture during ripening of the grain causes saccharide formation to predominate so that the grains are large and their relative nitrogen content falls. Also relevant is the effect of length of the growth period on the nitrogen content of the grain: the longer the growth period (whether because of cold, moist weather or the nature of the variety), the longer the period during which the amount of dry material in the grain increases, and accordingly the greater the yield.

Higher temperatures promote plant growth and thus the accumulation of proteins and saccharides. In this case the respiration rate increase faster than saccharide deposition and accordingly the protein-to-starch ratio increases.

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*[Prugar of Research Institute of Soil Science and Plant Nutrition (VUPVR), Bratislava; Hyza of Grain Research and Breeding Institute (VSUO), Kromeviz]

In addition, higher temperatures also favor microbial nitrification processes, which in turn enrich the soil and the plants in nitrogen. In addition, the temperature has a considerable effect on the plants' absorption of mineral nutrients from the soil, and changes in the intensity of mineral nutrition show up both in yields and in the chemical composition of the grain.

Temperature has an effect on the creation of the physical and physicochemical properties of grain which are so important for preparation, and this is even more important than its effect on the ultimate quantity of protein in the grain. An adequate supply of thermal energy is essential for normal ripening, which involves the formation of complex high-molecular-weight compounds from simpler building blocks. The temperature is critical to the colloidal material of the ripening grain. Grain which has considerable moisture in the waxy-ripe stage gradually begins to lose it, not only as free water, but also as water liberated in condensation reactions. The gluten begins to become more solid, because the colloidal processes in the grain proteins involve coagulation. But if the temperature during the ripening period exceeds the optimum, the grain becomes too dry and the protein structures become too hard, which shows up in the flour as decreased swelling ability in the gluten. The ideal weather for high yields and good grain quality thus entails abundant precipitation before flowering, followed by high air temperatures and low but adequate soil moisture.

Little attention has thus far been devoted to the effect of climate and soil factors on grain quality in the Czechoslovak literature. In the 1950's, Prugar of VURV [Research Institute of Crop Production] in Prague investigated the chemical composition and processing qualities of 24 varieties of winter and spring wheat in 21 localities with an extremely wide range of ecological conditions over a 2-year period. Subsequent studies by VURV systematically investigated the quality of Czechoslovak grains, while devoting attention to the relationship between quality indicators and climatic and meteorological effects on the crop. Prugar and Sasek (1969) attempted to find the interrelationships between the effects of ecological conditions at five locations in different production areas for three wheat varieties with different processing qualities. The same aim was addressed in the joint research of staff members of VURV Prague and VUO [Research Institute of Grain Growing] Kromeriz, which studied the effect of meteorological factors on processing quality of a wide selection of varieties in one location and used starch gel electrophoresis to analyze the proteins extracted. The results obtained by UKSUP [expansion unknown] Bratislava in variety trials with winter wheat in the corn-producing area of East Slovakia in 1969-1971 were evaluated by Baxa (1974). They confirmed that a moderator temperature without major deviations throughout the period from earing to complete maturity was optimal for grain quality. In the last 10 days before harvesting, evaporation should exceed precipitation. Thus hot dry weather--but not extremely high temperatures--is most favorable in the maturation period.

Among recent studies in this country we should mention those of Prochazka (1976) and Prochazka and Dudasha (1978), in which many years' data from variety trials, in various soil and climatic conditions, of the Mironovska variety of winter wheat are analyzed. These papers too conclude that high temperatures and low precipitation during grain formation and ripening improve quality, while abnormally high temperatures produce an overall worsening of quality. Skopek and Kastankova (1978) describe the variation in quality indices of wheat from various areas of Bohemia and Moravia.

Recent studies on the suitability of areas of Czechoslovakia for cultivation of bread wheat include those of Hyza (1981), Prugar (1981) and Vonka and Hyza (1979).

Data and Methods

The data for the map of local specialization in wheat cultivation in terms of quality were accumulated from our own work and the other domestic publications cited, and from data of the State Quality Inspectorates for Agricultural Products [both Czech and Slovak Republics] and of the agricultural procurement and supply enterprises, starting with 1954.

The whole of Czechoslovak was mapped out okres by okres by entering mutually comparable data (same evaluator, same year, some quality indicator). The sets of quality criteria differed by source: data from research papers were more extensive, including for example the results of farinographic evaluation, practical baking tests and the like, while those from other sources usually provided only basic data on baking quality in terms of gluten content and quality.

We calculated an average for each set of comparable results and then divided the data for the individual locations into three quality groups:

A--values at least 10 percent above the average;

B--values within 10 percent of the average;

C--values at least 10 percent below the average.

Thus each okres which was evaluated received a classification or "grade" for each set of data. The number of grades differed depending on data availability. For some okreses in the Czech Republic more than 20 quality indices were available, while the average in the Slovak republic was about 10 (for example, studies of the development of grain quality were not available in the SSR in the same detail as those provided by SIJ ZV [State Quality Inspectorate of Agricultural Products] in the Czech Republic.

Then, according to the average of the quality grades (ABC) we assigned each okres to one of five favorability classes in terms of its suitability for cultivation of bread wheat: excellent, very good, generally favorable, generally unfavorable, and unfavorable.

In the next stage of the work, in cooperation with the former Department of Soil Science in VURV (Dr Milan Tomasek, Csc), we refined the this preliminary version by comparing it with data on the soil map of Czechoslovakia (scale: 1 : 500,000). Our preliminary classification held up very well in this comparison, and only a few minor corrections were needed. The individual okreses were then broken down further in terms of predominating soil and climatic characteristics, producing a sketch map which was then worked up into final graphic form (Prugar, 1981).

Fig 1. Local specialization in bread wheat production in Czechoslovakia.

The second variant was developed on the basis of farinographic analyses of representative, comparable wheat samples taken during the regular wheat quality testing of the State Quality Inspectorate of Agricultural Products in the CSR, Data from GR PZN [expansion unknown] in Bratislava were used to evaluate product quality in the SSR.

As in the first variant, the information was entered on the map by okreses and a further breakdown was made in terms of data on weather and soil conditions. We also made use of five 5-year averages for the 7-month growth period encompassing tillering, earing, grain formation, ripening and harvest. In addition, we compared 30-year average hydrothermic coefficients for the months of June, July and August. These figures are in very good agreement with the analytical results from determination of the rheological qualities of doughs. This produced the final form of the second map variant.

The formula for calculating the hydrothermic coefficient was

$$HTK = \frac{R}{0.1\ TS10}$$

where R = precipitation and TS10 = sum of temperatures during period with temperature higher than 10° C.

In the next stage, both sets of data were compared and after further refining of the area breakdown of the Slovak Republic according to data from VUPVR [Research Institute of Soil Science and Plant Nutrition] Bratislava, we produced the final map (Fig. 1) of areal specialization in the production of break wheat in Czechoslovakia, which is presented here and is also available in a color edition at a scale of 1 : 100,000.

Results and Discussion

Study of the effects of climatic conditions and soil types on both the qualitative and quantitative aspects of grain production is of great importance under our country's circumstances. Czechoslovakia has an extremely varied geography, not only in terms of elevation, but also in terms of soil type. One practical consequence of this variety is that conditions in different area are favorable for successful, economically efficient cultivation of different sets of economically important crops. Experience indicates that not only individual crops, but even their varieties, may be less suitable for one area than for another, and accordingly that some varieties are best suited for cultivation in particular areas, where they can develop most fully and give the highest yields of the best quality product. Each variety has its own particular environmental requirements, i.e., for light, heat, moisture, nutrients and the like, and some areas may suit these requirements better than others.

The grain production sectorcan meet the requirements of the milling and baking industries on the one hand, and of the feeds industry on the other, only if it uses the mix of wheat varieties which produces optimal quality and consistently makes use of cultivation techniques.

Soil and Climatic Classification of Areas by Suitability for Cultivation of Bread Wheat

Areas with Very Good Conditions

According to agroclimatic conditions, the "rather warm" (1.1.3 according to Kurpelova et al., 1975) and "fairly warm" (1.1.4 areas in Bohemia, the "quite warm" (1.1.2) and "rather warm" (1.1.3) areas in Moravia and the "very warm" (1.1.1) areas in Slovakia are in this class. The main subregions are "quite dry" and "very dry".

This area has a long-term spring-summer average temperature of 14-17° C (particularly in Slovakia) and low precipitation (250-340 mm). The hydrothermic coefficient for June-August is very low (up to 1.4). These areas have high total sunlight, particularly in southern Slovakia (more than 1,500 hours during the spring and summer growth period), southern Moravia (1400-1500 hours), and northwest Bohemia (1300-1400 hours). The soil types are primarily meadow soils, chernozems, brown forest soils and rendzinas.

Areas with Generally Suitable Conditions

In agroclimatic terms these are "fairly warm" to "rather warm" areas in Bohemia and Morovia or "rather warm" to "Quite warm" areas in Slovakia and are subdividied into "relatively dry" and "quite dry" classes. The average spring-summer temperature is 13-15° C, precipitation is 350-400 mm in Moravia and Slovakia, and up to 350 mm in Bohemia, and the hydrothermic coefficient is 1.3-1.5. The quantity of sunlight ranges from 1400 to 1500 hours in Slovakia and from 1300 to 1400 hours in the Bohemian area. The soil types are brown forest soils, meadow soils and rendzinas, as well as chernozems in Bohemia.

Areas with Generally Unfavorable Conditions

In agroclimatic terms, these belong to the "moderately warm" (1.2.2) to "fairly warm" areas, with "moderately moist" to "moderately dry" subcategories. The average spring-summer temperature is 12-14° C, precipitation is 400-500 mm, or less in Bohemia, and the hydrothermic coefficient for June-August is 1.5-1.8; sunshine in the spring-summer growth period amounts to 1300-1400 hours in Slovakia and 1200-1300 hours in the Bohemia area. Podzol soils predominate, replaced by brown forest soils in lower areas. This area yields good grain only in extremely favorable years.

Areas with Unsuitable Conditions

These are cold-moist areas with average spring-summer temperatures of 11-13° C (with the exception of mountain areas) and precipitation exceeding 500 mm (with the exception certain areas in Bohemia). The hydrothermic coefficient exceeds 1.8. These areas also have small amounts of sunshine during the spring-summer growth period: up to 1300 hours in Slovakia and up to 1200 hours in the Bohemian area. The soils are for the most part highly podzolized.

We have used data accumulated from the scientific research base, breeding stations, variety trials and testing and procurement organization over the past 25 years to develop a map which will give quality-oriented guidance to

specialists in wheat production in this country. Areas with very good or generally suitable conditions for growing good quality bread wheat are rather uniformly distributed in our country, so that with suitable timing and choice of areas the processing plants can be supplied without the need for long-distance transport.

Developing and adhering to an area plan for the production of wheat for human and animal consumption will avoid the undesirable situation in which wheat of good processing qualities is used as feed and grain suitable only for feed is sent to the mills. The perfection of such an area planning system will yield considerable economic and social benefit by improving milling and baking products.

The agricultural sector was first acquainted with our results at the national conference "For High Yields and High Quality in Wheat Production" held in Prague in February 1980. Extensive experimental data indicate that area specialization in wheat production oriented toward quality can be rather precisely and suitably achieved in this country. Now that an updated procurement standard for wheat which takes account of quality factors is being introduced, the importance of just the results already discovered by our scientific research base is increasing. The knowledge of area specialization in the production of bread wheat must be used in assigning varieties to growing areas and in the assignment of production tasks in the individual krajs and okreses. Primary use should be made of the areas designated I and II, which can meet most of our country's requirements for grain for human consumption.

We should note the considerable year-to-year variation in meteorological conditions in this country, which necessitates flexible handling of specific situations with reference to the possible need for transport of harvested grain elsewhere. In addition, forecasting of harvest quality should be further developed and refined, following, for example, the technique now being developed by the Grain Research and Breeding Institute in Kromeriz for the use of the Ministry of Agriculture and Foodstuffs.

8480
CSO: 2402/48

BRIEFS

SYMPOSIUM ON IONIC POLYMERIZATIONS--An international microsymposium on "Progress in Ionic Polymerizations" began at the Institute of Macromolecular Chemistry of the Czechoslovak Academy of Sciences in Prague on 26 July. The microsymposium is being attended by some 70 experts from the USSR, Bulgaria, Hungary, the GDR, Poland, Romania and the CSSR. [Bratislava PRAVDA in Slovak 27 Jul 82 p 2 AU]

POWERPLANT MACHINERY FOR ROMANIA—The CSSR foreign trade enterprise Skodaexport has concluded a contract with the Romanian enterprise Romelectro of Bucharest on the delivery of three thermo-powerplant blocks for the Oradea-2 powerplant. The equipment consists of three boilers, each with a capacity of 420 tons of steam an hour, and burning low-grade Romanian coal, and of three turbogenerators, each with a capacity of 60 MW. [Prague MLADA FRONTA in Czech 28 Jul 82 p 2 AU]

CIVILIAN PLANES FOR USSR--The Let enterprise of Kunovice has supplied more than 300 small civilian aircraft of the L-410 UVP type to the USSR. Currently, the enterprise is working on tailoring the machine to the demands of the Soviet customer. The range of the aircraft will be extended to up to 1,500 km, and some machines will be made especially for the use by the USSR fishing fleet, for fire-fighting, for deployment as flying ambulances, for photogrammetric experts, and for use in the Arctic region with skiis as landing gear. [Prague PRACE in Czech 28 Jul 82 p 3 AU]

CSO: 2402/66

EC 1055M COMPUTER SYSTEM DESCRIBED

Overview of System

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No. 1, Feb 81 p 1

/Overview of EC 1055M computer system by Walter Muench, member, RECHENTECHNIK-DATENVERARBEITUNG editorial advisory board: "EC 1055M." Translations of articles describing the components of the system described below are published following this introductory article. Translations of the articles describing the operating systems will be published in a subsequent issue of the EAST EUROPE REPORT: SCIENTIFIC AFFAIRS/

/Text/ Everywhere in our republic, great services are being rendered to strengthen the republic in preparation for the 10th Party Congress of the SED. For the employees of the State Enterprise Combine Robotron, it is also incumbent by means of the most recent information from science and technology, to produce still more efficiently, and to fabricate still more available final products with a lesser expenditure of materials and energy. Considerable results were achieved along this route.

This edition of "Computer Technology/Data Processing" reports in detail concerning a new product of the creative work of the employees of the Combine - the Model EC 1055M. This model will for the first time be presented to the public at the Leipzig Spring Exhibition in 1981.

This model is more powerful than its predecessor. For example, only two cabinets are required for the entral unit - a convincing contribution to materials economy. Due to the use of modern components, less energy is consumed.

The EC 1055M is a development of the ESER (RYAD). We recall once again: During the years 1978 through 1980, the models EC 1015, EC 1025, EC 1035, EC 1045, and EC 1055 of the RYAD, Series 2, were subjected to a joint test and were transferred to production. In different degrees, modernization stages have since then begun for the individual models. While retaining the basic principles specified for Series 2 (general technical requirements), they strive for an increase of utility corresponding to increasing user requirements.

As the result of modernization, Model EC 1055M was developed from Model EC 1055. It is essentially distinguished by the following new components:

Central unit EC 2655M with a main storage capacity up to 4 M bytes and a loadable microprogram memory

Operating and service processor EC 7069N with an expanded functional scope, greater operating convenience, and standard floppy disk for loading the microprogram memory of the EC 2655M

Matrix module as additional high power computer unit to perform numerical operations which process large quantities of data - e.g. matrix and vector operations

A further developed operating system OS/ES with improved or new functions, access methods, compilers, etc.

The operating system SVM/ES, which makes it possible to simulate several virtual machines on one real data processing system as well as to operate in the conversational mode and in the batch mode in parallel

Inclusion of further I/O units in the model inventory, e.g. the display screen system EC 7920M, the device station EC 7902M, and the 100-M byte moving head disk EC 5567/EC 5067*.

Although the operating speed of the EC 2655M is not greater than that of the EC 2655, Model EC 1055M, compared to the previous Model EC 1055, has new or improved components and, on this basis, offers an extended application range, higher system performance, and a decisive increase of processing power for special tasks.

Since the new devices can also be connected to the EC 2655, and since the improvements of the basis program support are likewise effective for this central unit, the utility of data processing systems based on the EC 2655 is also increased by using the new model components, taking into account certain functional restrictions.

The operating system SVM/ES is available in RYAD only for the Models EC 1055/EC 1055M. The operation of the SVM/ES can be speeded up by microprograms of the central unit (SVMA support). This results in favorable effects for the user due to the application of higher integrated memory switching circuits and a new power supply. Despite an increase in the maximum main storage capacity by a factor of two, the number of central unit cabinets could be reduced to two and the power consumption of the central unit could be reduced to about 4.1 kW.

In the following articles rd (computer technology - data processing) will present the new model components in more detail.

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*A paper concerning this unit will be published at a later time.

1982 Leipzig Fair Report

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 19 No 5, May 82 pp 19-23

/Report signed "Lo./Pa." on 1982 Leipzig Spring Fair: "High-Performance Computer Technology--New User Solutions--Data Processing Adapted to the Work Place/

/Excerpts/ The tradition-rich international place of commerce, Leipzig, in March 1982 attracted numerous important manufacturers of writing, computing, and communications technology. As in the previous years, the stands in halls 15 and 18, on the terrain of the technical exhibition, were always besieged by a crowd of exhibition guests eager for knowledge, who wanted to be informed firsthand concerning the further developments of scientific-technical progress in this area.

The Spring Fair at Leipzig has already for many years played the role of a trend indicator for computer technology; all significant new developments of our EDP utilization had their starting point here. The following trends, among others, could be delineated for the 1982 Fair:

The present program of the VEB (State Enterprise) Combine Robotron, beginning with office computers up to the RYAD-2-EDVA, which were first presented in 1980 and 1981 respectively, has been completed, expanded, and more rigorously adjusted for the user. Determinative factors this time were software solutions, where the particular hardware represented only means to an end. - Application solutions are being emphasized more from year to year.

Robotron Multicomputer System EC 1055/EC 1055M

The VEB Combine Robotron is constantly working on the development of newer data processing technology and on variants of its effective utilization. An example of this is the multicomputer system EC 1055/EC 1055M.

By coupling EC 1055 EDP systems, multicomputer systems can be formed, in which the coupled central units always operate under the control of their own operating system and with their own main storage. The level of a multicomputer system is determined by the programming support of the existing devices and equipment.

The coupling of the systems can be implemented with the following technical capabilities:

Channel-channel adapter
Direct signal control
Device control units with two-channel connection.

The equipment of individual EDP systems with peripheral units was minimized, for space reasons, to the extent necessary for the demonstration. Both computers were operated with the operating system OS/ES (Edition 6.1).

The demonstration of applications on the Robotron multicomputer system was performed by using the components MMS (multimachine support) of the operating system OS/ES. The interaction of two EDP systems was demonstrated by means of a prefabricated program packet PDV (program controlled file processing):

Starting from two files with statistical data, one file was built up through computer A. This file, whose structure was controlled by means of parameters, was transferred through the KKA to the computer B. There it was evaluated according to certain criteria desired by the interested party (parameter control), and the results were outputted on printed lists or were recorded on disk. The operator units record information concerning the collaboration of the computers. Furthermore, rapid data exchange between two main storage units, without the intermediate connection of peripheral devices, was also demonstrated.

In summary, the multicomputer system achieved the following advantages:

high performance capability with increased program throughput

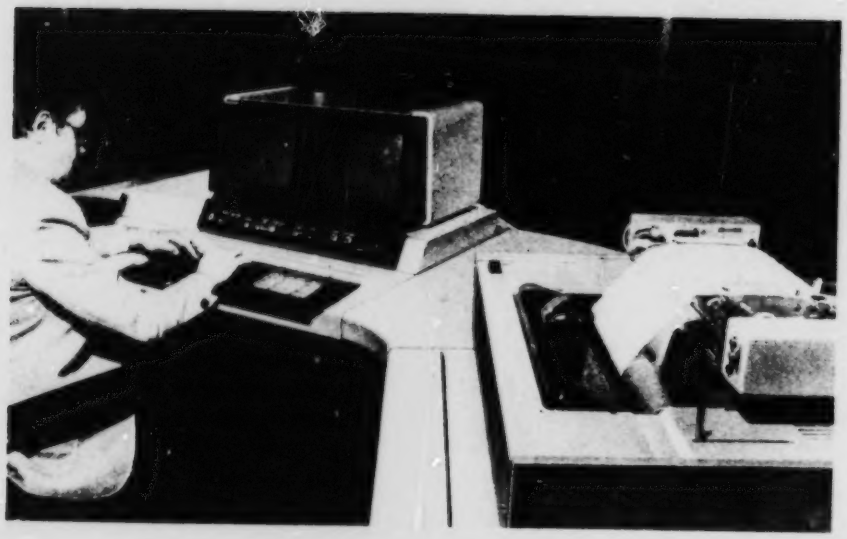
increase of reliability against breakdowns of the computer system and thus high system availability

data exchange at a great speed through the channel-channel adapter

structure, management, and utilization of extensive data banks with constant availability through access from both computers to the same storage media

uniform loading of two computers and better utilization of system resources

facilitating the work organization with a simplification of the technological conditions in the computer system.



Operating and Service Processor EC 7069 and Printer 1154 in the Multicomputer System EC 1055/EC 1055M

8348
CSO: 2302/4

EC 2655M CENTRAL UNIT FOR EC 1055M COMPUTER DESCRIBED

Performance Specifications

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 2, Feb 81
back cover

/Back cover series on "EDP Equipment," signed "MÜ": "EC 2655M Central Unit"/ —

/Text/ EC 2655M is a central unit of the ESER (RYAD), series 2. It represents a modernization of the EC 2655.

Technical Data:

Operating speed in thousands of operation per second (TOP/s)	
GIBSON-3 (single precision)	473
GIBSON-3 (double precision)	425
GPB-WU II	238

Instruction execution time in microseconds	
Addition/subtraction, fixed point	0.93- 1.12
Addition/subtraction, floating point (single precision)	2.84- 3.64
Addition/subtraction, floating point (double precision)	3.04- 3.65
Multiplication, fixed point	7.26- 9.17
Multiplication, floating point (single precision)	6.29- 6.69
Multiplication, floating point (double precision)	9.54- 9.96
Division, fixed point	20.05-22.54
Division, floating point (single precision)	22.36-11.38
Division, floating point (double precision)	18.54-18.56
Transfer, unconditional	2.38- 2.39
Short operations	0.93- 2.64

Number of instructions	182

Main storage	
Technical Base	16 K Bit dynamical RAM
Storage capacity in M bytes	1; 2; 3; 4
Calling width in bytes (quadruple overlap)	8
Cycle time in nanoseconds (ns)	600
ECC code	

Microprogram memory, loadable	
Technical basis	1 K Bit
Storage capacity in K words	9
Permanently programmed (K words)	8
Freely programmable (K words)	1
Word length in bits	66
Channels	
Maximum number	5
Total data transmission rate in M byte/s	6.0-7.0
Byte multiplex channels	
Maximum number	2
Maximum transmission rate in selector operation in k byte/s	1500
Maximum transmission rate in multiplex operation in k byte/s	40
Maximum number of subchannels	256
Block multiplex channels	
Maximum number	4
Maximum transmission rate with 1-byte transmission in k byte/s	1500
Maximum transmission rate with 2-byte transmission in k byte/s	3000
Maximum number of subchannels	256

(Photo: EC 2655M Central Unit)

Installation data

Number of cabinets	2
Needed area in m^2	1.74
Power consumption in kilowatts	4.1

Other function characteristics
  Virtual storage principle
  Connection for matrix module
  Basis program support
Furnishing the edition 6.1 of the OS/ES
System of virtual machines SVM/ES
expanded diagnostic means
  Microprogrammed control program support for the operating system SVM/ES (SVMA).

Description of EC 2655M Central Unit

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 2, Feb 81 pp 2-6

/Article by Wolfgang Lampenscherf, Dieter Linzmann, and Horst Otto, VEB Robotron ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 2655M Central Unit/

/Text/ The central unit EC 2655M is the further development of the central unit EC 2655. The following functional units are new, where the remaining structure and the functional principles were retained /1/:

Expanded main storage on a highly integrated circuit basis
New main storage adapter and key storage, matched to the new main storage
Loadable microprogram storage based on highly integrated circuits
New transformerless power supply from the mains in a modern design
Operation through an operating and service processor EC 7069M
Microprogrammed control program support for the operating system SVM/ES (SVMA).

These modernizations are characterized by the following data:

Increase of main storage capacity from 2 M bytes to 4 M bytes. The double main storage capacity, in combination with a modern operating system, favors user operation, increase of job throughput, and thus makes computer operation more efficient. The mode of operation in the virtual storage concept and by staticizing working files in main storage, relieves external storage media such as e.g. moving head disks.

Reduction of the device volume and of the needed area, by using highly integrated dynamical storage circuits with a capacity of 16 K bits, from the previous four cabinets with a maximum main storage size of 2 M bytes to two cabinets for the entire central unit including main storage, with simultaneous doubling of the maximum main storage capacity to 4 M bytes. The required area of the CPU is reduced from 3.7 m^2 to 1.74 m^2.

Loadable microprogram memory with a capacity of 8 K microinstructions for the permanently programmed area in place of the previously used inductive ROM and a

significantly expanded storage capacity for the permanently programmed section of 1024 microinstruction as compared to the previous 32 microinstructions. The loadable microprogram memory permits rapid interchange between different versions of microinstruction sets. The expanded supplementary section and the expanded and accelerated loading possibilities through the CPU yield advantages for diagnostics.

Significantly reduced power consumption by using highly integrated circuit technology in the memories and by simplified switching networks with high efficiency, after the transformerless principle, from the previous 7.4 kW to about 4 kW. Another advantage in terms of applications is a reduced requirement for air conditioning.

In combination with the operating and service processor EC 7069M, significantly expanded and more flexible service possibilities in combination with loading capabilities for two floppy disk unit to load special service supports.

With the new internal functional principles of the operating and service processor 7069M, which works on a microprocessor basis, a novel solution is offered for the operating unit. In the following sections, the modernized and functional units will be briefly characterized.

1. Main Storage

Compared to the EC 2655, the main storage of the EC 2655M represents a further improvement as regards storage capcity, volume reduction, and power saving. This could be achieved by using 16 K-bit RAM storage circuits and by using proven technological and technical solution principles as well as by simplifying control sequences.

The maximum capacity of the main storage is 4 M bytes, where a separate access region was dispensed with. Because of the high degree of integration of the storage circuits, the entire capacity can be housed on two panels in the cabinet of the central processing unit (CPU), so that the storage cabinet as such could be omitted and consequently a complicated bus-line system with special cable drivers and receivers could be dispensed with. Dynamical 16 K-bit MOS circuits are used as storage circuits. These have a one-transistor cell as the basic element for storing one bit.

The 16384 storage cells of a storage circuit are formally arranged in 128 rows and 128 columns. To select the cell, 14 address bits are required, which are always offered to the circuit, as 7 address bits, in temporal sequence. This circuit then activates them.

Since dynamical RAM's are involved with the storage circuits, regeneration cycles are necessary to maintain the written information. In a regeneration cycle, all the cells of a row are regenerated, so that 128 regeneration cycles are necessary to regenerate 1 storage circuit. Each cell must be refreshed after 2 ms, which results in a spacing of about 15.6 µs between two regenerations. A regeneration counter monitors adherence to this time interval. For this purpose, it counts an appropriate number of timing cycles, and then initiates a regeneration request

which is reset after the regeneration has been completed. If the CPU does not execute any regeneration cycles, it delivers a release signal which permits regeneration. If no regeneration was possible within 15.6 MS, a gap for regenerating is forced by means of a blocking signal that is delivered by the main storage unit. The regenerations take place synchronously in time with the timing cycle scheme of the CPU, whereby simpler control sequences now result. For special test purposes, it is possible to vary the regeneration spacing.

Main storage has a capacity of 1, 2, 3, or 4 M bytes. On each of the above-mentioned two panels, the 36 bits of a word are stored. The implementation of the different main storage sizes is achieved by a different number of plug-in storage units, where this number is the same for each module, however. This is communicated to the CPU through special signals. The capacity of main storage with the minimum size (4 X 256 K bytes) is subdivided into a total of 12 storage plug-in units, where each module on each panel - that is twice altogether - requires a whole and a half plug-in unit. With the remaining expansion stages, the number of storage plug-in units multiplies correspondingly. Each plug-in unit has a capacity of 32 K bits in depth, with a calling width of 24 bits, which results in a minimum capacity of 256 K bytes per module, with a double word width of 72 bits. It is also possible to operate with 1, 2, 3, or 4 modules, where the modules can be started sequentially with an overlap at a spacing of 400 ns. The cycle time is 600 ns, so that, after two cycles, the same module can be called again or can be regenerated after 1.5 cycles. With overlapped 3- or 4-module operation, therefore, the regeneration cycles can therefore be performed in covered fashion.

No storage testing equipment has been provided for this storage unit.

2. The Main Storage Adapter (MSAD)

The MSAD receives addresses and data from the users of main storage (CPU, central channel section, MAMO) and delivers the addresses and control signals necessary for main storage or in turn receives them from main storage. The MSAD appropriately forms the starting and address signals in dependence on the configuration and on the overlapped operation of the main storage modules.

When the configuration state is changed, the modules can be switched on and off. Module capacities of 256, 512, 768 K bytes or 1 M byte can be configured. The supplementary regions can be correspondingly configured for 16 and 32 K bytes.

The mode of operation with four modules is normally overlapped four-fold. Other operating modes have already been described in connection with main storage. The key memory was expanded to 2048 bytes, corresponding to the increased storage area of main storage. By using static 1-k bit RAM circuits, the space requirement for this memory was reduced from eight plug-in units to one.

The regeneration mode of main storage was simplified by the limitation to four modules which, however, are configurable as regards their size. The supplementary storage regions (16- or 32-K bytes respectively) are now situated at

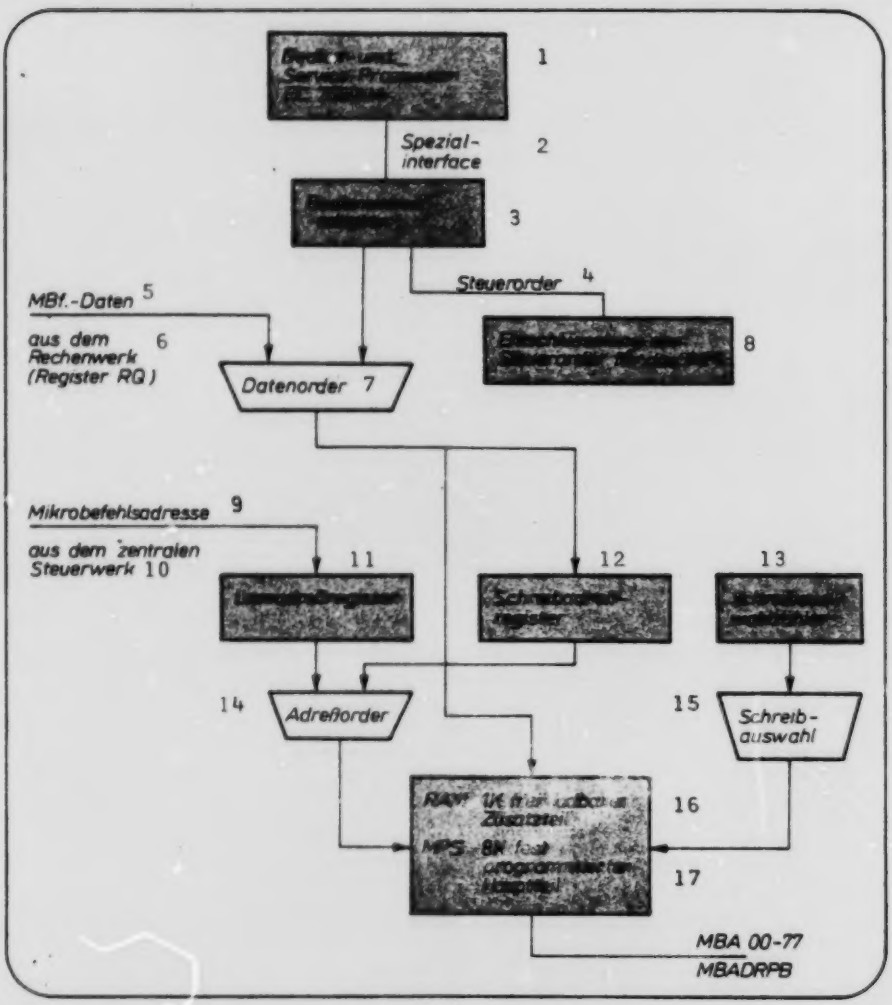


Figure 1: Coarse Structure of the Loadable Microprogram Memory

Key:

1. Operating and service processor EC 7069M
2. Special interface
3. Operating unit adapter
4. Control order
5. MBf data
6. From the computing unit (Register RQ)
7. Data order
8. Decoding the control order for the IMPL
9. Microinstruction address
10. From the central control unit
11. Read address register
12. Write address register
13. Write selection counter
14. Address order
15. Write selection
16. RAM 1K freely loadable supplementary section
17. MPS 8K permanently programmed main section

the upper end of the physical address area of main storage. The diagnostic equipment of the CPU were appropriately adapted to the newly developed function groups.

3. Microprogram Storage

The MPS of the EC 2655M is a loadable MPS which is built up of 1 K X 1 bit static RAM elements. It replaces the ROM-MPS of the EC 2655 (word-organized inductive read-only memory). The RAM-MPS is housed in the panel 11D in place of the ROM-MPS. The capacity of the RAM-MPS is 9 K microinstructions with 66 bits each, whose format completely agrees with that of the EC 2655. The RAM-MPS consists of a permanently programmed main section (8 K microinstructions), which corresponds to the ROM-MPS of the EC 2655, and a freely loadable supplementary section (1 K microinstructions). With the EC 2655, the supplementary section has only 32 microinstructions.

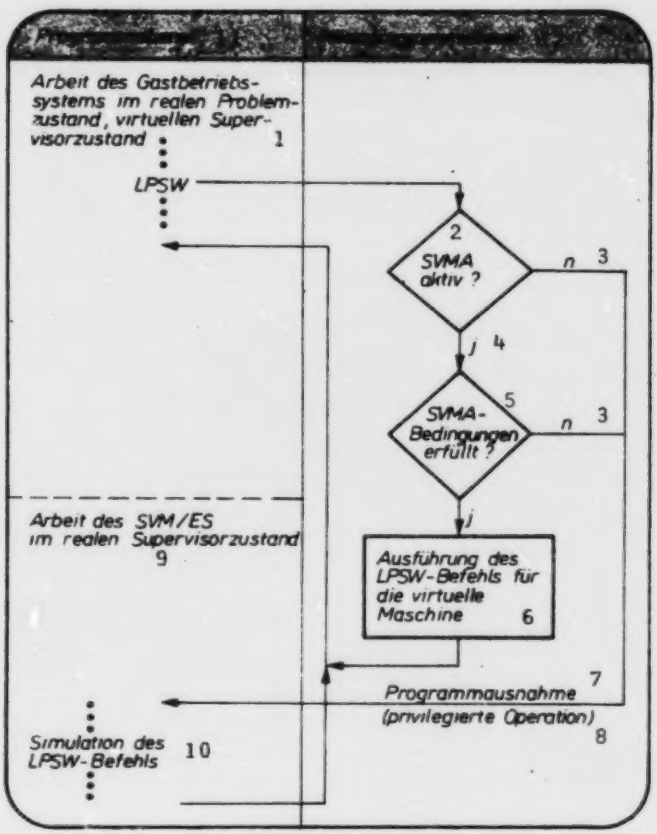


Figure 2: Mode of Operation of the Microprogrammed Control Program Support (Using as an Example an LPSW Instruction)

Key:
1. Operation of the guest operating system in the real problem status, virtual supervisor status
2. SVMA active?
3. No
4. Yes
5. SVMA conditions fulfilled?
6. Execution of the LPSW instruction for the virtual machine
7. Program exception
8. Privileged operation
9. Operation of the SVM/ES in the real supervisor status
10. Simulation of the LPSW instruction
11. Program level
12. Microprogram level

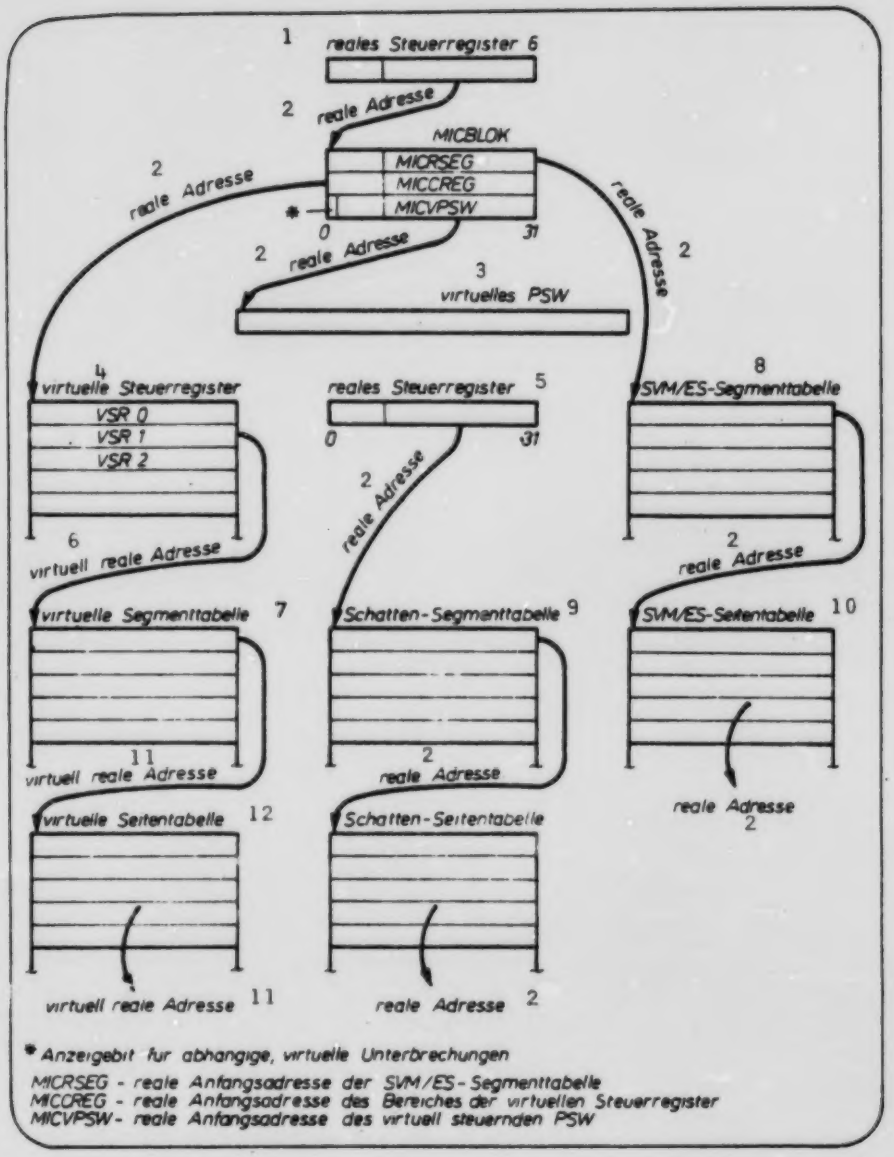


Figure 3: Control Data and Address Conversion Tables Used by the Microprogrammed Control Program Support (SVMA)

Key:

1. Real control register 6
2. Real address
3. Virtual PSW
4. Virtual control register
5. Real control register
6. Virtual real address
7. Virtual segment table
8. SVM/ES segment table
9. Shadow segment table
10. SVM/ES page table
11. Virtual real address
12. Virtual page table

*Indicator bit for dependent, virtual interrupts
MICRSEG - real starting address of the SVM/ES segment table
MICCREG - real starting address of the region of the virtual control register
MICVPSW - real starting address of the virtual controlling PSW

When the data processing system is switched on, the microinstruction data must be stored in the RAM elements. These data are loaded from the BSP EC7069M via the special interface. The RAM-MPS loading is a new function of the BSP EC 7069M, the initial microprogram loading (IMPL). For this purpose, two new orders were defined at the special interface. The order E is intended for control purposes in connection with the IMPL. The order D always transmits one microinstruction byte. The IMPL can also be triggered by the EC 7069M via an operating picture.

There are two versions of microinstruction sets for the permanently programmed main section of the RAM-MPS. Both of these versions can be loaded:

SVMA
MAMO.

The version that is actually loaded depends on whether or not the MAMO is switched on. The RAM-MPS can be loaded not only through the IMPL but also through the CPU directly from the register RQ. The microstatement VR1 is used for this, and this statement is modified by bits 20 and 21 of the microinstruction. The RAM loading microprogram now makes possible both the loading of individual microinstructions and the loading of microinstruction blocks beginning at a certain starting address. Changing the RAM-MPS is equally possible in main storage and in the supplementary section. By means of the direct connection of the RAM-MPS with the register RQ, as well as by means of the capability of continuous loading beginning with a certain starting address, the loading rate of the CPU was raised considerably as compared to the EC 2655.

4. Power Supply

As with the EC 2655, the power supply is housed in cabinet 2 together with the associated control and monitoring equipment. But it represents a completely novel development. Transformerless switching circuits of an integrated construction type are used here.

5. Microprogrammed Control-Program Support

5.1 General Considerations

The control program of the SVM/ES makes it possible to operate several virtual machines with their associated operating systems and problem programs on one real data processing system (e.g. the EC 1055). For this purpose, the resources of the real data processing system are assigned by the SVM/ES to the individual virtual machines in a time-limited fashion. The technical device characteristics of a virtual machine can be set down in a specification. Although e.g. the real EDP system has available only one set of real control registers, several machines can use their own control registers. In this case one speaks of the virtual control registers of a virtual machine. Likewise, every virtual machine has a virtually controlling PSW. A special data block (VMBLOK) exists in main storage

for each virtual machine. This data block reflects the technical device properties of the virtual machine. During the time that a virtual machine is supposed to work, the SVM/ES activates the control information belonging to this particular virtual machine, i.e. staticizes this information in the real control equipment (e.g PSW).

The SVM/ES here changes the control information in such a fashion that it retains for itself control over the real device technology. If a virtual PSW e.g. indicates the supervisory status, the SVM/ES sets the problem status bit into the real PSW when this virtual PSW is activated. The machine then operates in the real problem status and in the virtual supervisory status. The virtual supervisory status is flagged in bit 1 of the control register 6. This makes certain that, while the virtual machine is operating, justified privileged instructions can be distinguished from unjustified ones (erroneously used ones). In the real supervisory status, only the control program of the SVM/ES can operate.

But for a few exceptions, the SVM/ES organizes operation with virtual machines in such a fashion that, from their point of view, the activity of the SVM/ES remains transparent. When processing time-dependent programs in a virtual machine, however, there are differences compared to their processing on a real EDP system that is exclusively assigned to these machines. With the introduction of the additional control level associated with the SVM/ES, the running time of the problem programs is affected. To keep this influence as small as possible, the microprogrammed control-program support (SVMA) was created. This support is especially important when an operating system, which operates with dynamic address conversion (control-program configuration SVS of the OC-6 EC), is supposed to run in a virtual machine under the control of SVM/ES. Since the SVM/ES always uses dynamical address conversion, a double address conversion is necessary in this case.

5.2 Purpose and Functional Scope of SVMA

SVMA consists of a number of new as well as modified microprograms and is used to speed up program processing under SVM/ES. The control program of the SVM/ES causes the guest operating systems (operating systems which run under the control of SVM/ES) to be activated in the real problem state. All privileged instructions which are executed while working on a virtual machine consequently generate program exception conditions which must be handled by the control program of the SVM/ES (simulated). If SVMA is present, the consequent high proportion of supervisory status time is reduced because SVMA can in many cases simulate the privileged operations for the virtual machines automatically. The control program of the SVM/ES must be called only in privileged operations, in which the simulation of the privileged operations cannot be achieved by SVMA (Figure 2).

Execution of the following privileged operations (in the real problem status) is supported by SVMA:

LRA - Load real address
STCTL - Store control register
RRB - Reset access bit
ISK - Insert storage key
SSK - Set the storage key
IPK - Insert protection key
SSM - Set system mask
STNSM - Store system mask and change conjunctively
STOSM - Store system mask and change disjunctively
LPSW - Load program status work
SPKA - Set PSW protection key.

Furthermore, SVMA permits execution of SVC instructions (except SVC76) in the virtual machines, without SVM/ES having to activate the control program. An SVC interrupt for the particular actual virtual machine is here simulated on a microprogram basis.

Besides supporting privileged operations and SVC instructions, SVMA comprises a microprogram routine for handling page invalidity exceptions. By means of this routine, it is possible to avoid program interrupts as a consequence of page invalidity exceptions, if both the conversion tables of the guest operating system and also those of the SVM/ES control program contain valid entries. This achieves a further speed-up of program processing under SVM/ES.

If SVMA determines conditions which prohibit the microprogram implementation of the specified support functions, this will generally lead back to the respective normal functions, i.e. to program interrupts because of privileged operations, to SVC interrupts, and to program interrupts due to page invalidity exceptions. The operation of the CPU in the case of errors on the part of SVMA or if the SVMA has not been activated is here designated as a normal function.

5.3 Equipment Required by SVMA

Control register 6 is necessary for the operation of SVMA. This control register contains several control bits and the address of an address list which must be furnished by the control program of the SVM/ES. The following occupation holds for control register 6:

Bit 0 = 0 SVMA not activated
= 1 SVMA activated
Bit 1 = 0 The virtual machine operates in the virtual supervisory status.
= 1 The virtual machine operates in the virtual problem status.
Bit 2 = 0 Execution of ISK and SSK is permitted under SVMA.
= 1 Execution of ISK and SSK is not permitted under SVMA.
Bit 3 = 0 All the specified privileged operations (corresponding to the instruction list of RYAD Series 2) may be supported by SVMA.
= 1 Only the specified privileged operations which belong to the instruction list of RYAD Series 1 (SUM, LPWS, ISK, SSK), may be supported by SVMA.

Bit 4 = 0 Execution of SVC instructions by SVMA is permitted.
= 1 Execution of SVC instructions by SVMA is not permitted.
Bit 5 = 0 Handling the shadow tables by SVMA is not permitted.
= 1 Handling the shadow tables by SVMA is permitted.

Bits 6 and 7 have no significance for SVMA.

Bits 8-31 contain the real address of an address list (MICBLOK) (bits 29-31 must be zero).

The specified address list (MICBLOK) begins at a double-word limit and contains three words. A real main storage address is stored in each word. The address in the first word represents a pointer to the real segment table of the SVM/ES. The address in the second word represents the pointer to the virtual control registers, while the address in the third word indicates the real main storage location at which the virtual controlling PSW begins (Figure 3).

Bit 0 of the third MICBLOK word is furthermore used as an indicator bit. If this bit equals 1, a virtual interrupt request follows. Both control register 6 and the MICBLOK are read by SVMA but are not changed. (An exception is bit 1 of control register 6 in the case of the LPSW instruction.)

5.4 Activation and Mode of Operation of SVMA

After the required control information in the MICBLOK as well as in the respective system regions (virtual control registers, virtual PSW, address conversion tables) has been furnished, the operation of SVMA can be activated by loading control register 6 with a suitable control word. A necessary presupposition for the operation of SVMA furthermore is the real problem status in the active PSW. During the real supervisory status and also while the LEX mode is switched on (concerns DOS/ES emulation), SVMA is not functional.

If SVMA has been activated, execution of one of the specified privileged operations in the real problem status does not directly entail a program interrupt (privileged operation). First, further conditions are tested which must be fulfilled for the execution of the respective operation with SVMA. Among these also belongs a check of the associated control bits in control register 6, interrogation of the LEX mode, and testing of the MICBLOK address in control register 6 with respect to adherence to the double-word limit requirement. If one of the above conditions is not fulfilled, SVMA terminates its activity for this operation and a program exception (privileged operation) is reported. The further execution sequence occurs as if SVMA were not present. If the above conditions are all fulfilled, the instruction is executed according to the SVMA specification. In accord with this specification, further exception conditions can here be recognized, which likewise entail the report of a program exception (privileged operation). In some cases, access exceptions are also recognized and reported. No distinction is here made whether the access exception has occurred because of an error in the SVM/ES or because of an error caused by the programs of the virtual machine. In every case, an interrupt occurs with

transfer of control to the SVM/ES. An exception to this are page invalidity exceptions which, in certain cases, first continue to be handled by the SVMA. For non-privileged operations (except SVC), support from SVMA in principle exists only if page invalidity exceptions occur. This support, however, is bound to the use of dynamical address conversion in the virtual machine (EC and DAT bit equal to one in the virtually controlling PSW).

With the SVM/ES, the available real storage is divided according to the requirements of the virtual machine. For this purpose, SVM/ES structures the storage into 64-K segments, each with 16 4-K pages.

An operating system which runs in the BC mode in a virtual machine consequently is thus also subject to the dynamical address conversion introduced by SVM/ES.

This process is transparent for the guest operating system.

Page invalidity exceptions which may occur thereby are not supported by SVMA, but are fed to SVM/ES and are handled in well-known fashion. If the operating system in the virtual machine works with dynamical address conversion, a double address conversion becomes necessary since the addresses which are real from the point of view of the guest operating system (designated as virtual real addresses) must still be converted through the tables of the SVM/ES. This double address conversion is supported by SVMA. So-called shadow tables are furnished for this by SVM/ES. The formatting of the shadow tables corresponds to the formatting which obtains for the conversion tables of the guest operating system. All combinations of 1-M byte or respectively 64-K segments as well as 4-K and respectively 2-K pages are possible here. If a page invalidity exception occurs, SVMA attempts the double address conversion and, if the conversion is successful, an entry is made in the shadow page tables. The interrupted instruction is then repeated automatically. In this fashion, the logical addresses used in the virtual machines are associated with the real addresses of the main storage unit, through the shadow tables. This association is also staticized in the TLB when the logical addresses are used. If the required double address conversion cannot be implemented by SVMA, the original page invalidity interrupt is handled completely in the usual fashion, and control is transferred to SVM/ES. The shadow tables are the active tables which are used by the address conversion equipment. The shadow segment table starting address is situated in the real control register 1.

Accordingly, three address conversion table sets belong to a virtual machine in which an operating system is operating with dynamical address conversion:

Conversion tables of the guest operating system
Conversion tables of the control program of SVM/ES
Shadow tables (Figure 3).

When working with virtual machines under the control of SVM/ES, processing is faster by a factor of two if SVMA is used, than if SVMA is not used.

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CSO:2302/4

EC 7069M CONSOLE, SERVICE PROCESSOR FOR EC 1055M DESCRIBED

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German Vol 18 No 2, Feb. 81
pp 7-10

/Article by Heinz Voigtlaender, VEB Robotron ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 7069M Console and Service Processor"/

/Text/ The operating and service process (BSP) EC 7069M is a successor and further development of the operating unit (BE) EC 7069. The purpose of the BSP is to guarantee not only the systems servicing of ESER (RYAD) systems (communication between the operator and the operating system) but also maintenance servicing (communication between the maintenance engineers and the device technology). Its further function is to control initialization of the central unit (CPU) (monitoring main power switch on, loading of microprogram memory), and extensive support during service, in diagnostics, and in operating the EDP system. Thus, the functional scope and servicing convenience are significantly expanded as compared to the BE.

The possibility basically exists of connecting the BSP to other CPU's of Series 1 and 2 of RYAD, inasmuch as these accept the serial special interface (SPIF).

The BSP EC 7069M is an autonomous unit equipped with standardized connections and thus can be set up at a location that is optimal for servicing the EDP system. The length of the connection cable between the CPU and the BSP may be at most 60 meters.

As an input/output (I/O) unit, the BSP operates in two different and mutually exclusive operating modes which can be selected by the operator and which are designated as

Typrewriter operation mode (SM) and respectively
Display screen/printer operation mode (DM).

1. Basic Structure

The BSP EC 7069M is a sit-down work station and comprises the following equipment:

Electronics complex
Two display screens (monitors)

Operating panel
Power supply
Two floppy disk drives
Standard interface connection (SIF)
Special interface connection (SPIF)
Power supply-control-interface and system control-interface connection
Means for maintenance and diagnostic purposes
Means for acoustic signaling
Clock
Printer.

2. The Modular Principle (Figure 1)

The electronics of the BSP represents a modular multi-microprocessor system. All subassemblies are connected, in the form of modules, to an internal universal bus. In this way, it is possible to replace individual modules, to add them, or to omit them, without this requiring significant changes of the entire apparatus. This universal bus, with its characteristics, makes possible the following:

The data transmission can be executed between arbitrary connected devices according to the Master-Slave Principle

Every connected device can in principle act either as a master or a slave

Data are transmitted byte-parallel

The data rate in multiplex operation is about 300 k bytes per second

For special cases one can work in the burst mode, where a higher data rate can be attained.

The 20 address lines make available an address space of 1 M byte. Special lines and transmission procedures are provided for internal diagnostics and for maintenance and troubleshooting purposes.

3. Function Complexes and Modules

As already explained, the BSP uses a modular structure which is further supported by the new circuit board technology.

The entire logic is subdivided into function complexes (Figure 1) and further adapters. Each function complex is housed on a 390 X 270 mm circuit board. By adapters are also understood the circuit boards with cable stages for the SIF and SPIF. They are used to adapt the particular connection pictures of the units (e.g. floppy disk drives, printer) to the connection conditions of the function complexes.

The bus control has the following tasks:

Transmission of bus requests
Triggering of bus cycles

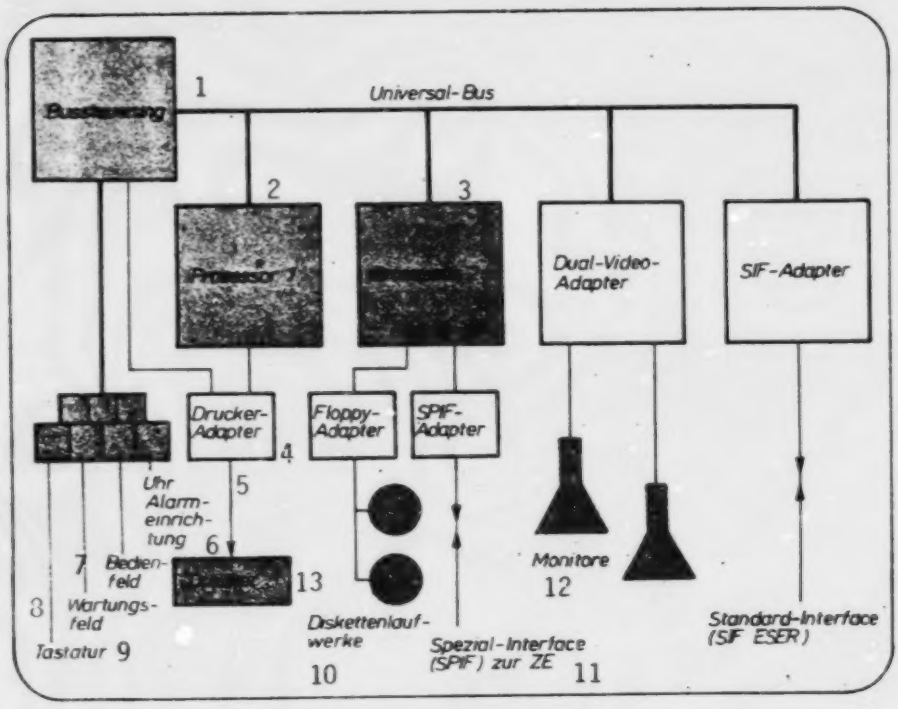


Figure 1: Modular Structure of the Operating and Service Processor (BSP) EC 7069M

Key:

1. Bus control
2. Processor 1
3. Processor 2
4. Printer adapter
5. Clock
6. Alarm device
7. Operating panel
8. Maintenance panel
9. Keyboard
10. Floppy disk drives
11. Special interface (SPIF) to the CPU
12. Monitors
13. Printer

Checking the execution of bus cycles
Handling hardware errors
Execution of maintenance functions
Execution of service functions which are requested by other complexes (e.g. setting and interrogating the clock, emitting acoustic signals).

The ROM memory of the bus control comprises 9 K bytes, and in it are stored the microprograms necessary for this complex of functions.

The processor (SBC/32 K) is a compact microcomputer with a storage capacity of 32 K bytes. Just as with the bus control, microprograms are stored in a 4 K ROM memory, where these microprograms are also used for the internal diagnostics of the processor.

The 32-K byte RAM memory permits parity tests and a comparison-stop operating mode for maintenance and program testing. A storage protection device is also provided.

A processor generally has two tasks:

Processing the BSP-internal programs
Controlling peripheral equipment (printer, floppy disk drives, SPIF).

Usually, the distribution of task is organized in such a fashion that, after the system has been established, the processor processes the internal programs in its basic state and the peripheral control is activated through interrupts.

The Dual Video Adapter (DVIA) provides the deflection, synchronization, and video signals for the independent control of two monitors. Twenty-four lines with 80 characters each are always shown on each display screen. A picture memory for eight pictures (16 K bytes and additionally 16 K bits for the cursor display) is provided for each display screen. This memory can store not only alphanumeric characters but also field-control characters, so as to control the display on the screen.

A field-control character is a non-display character with a subsequent field-control action on the following alphanumeric characters until the next field-control character.

Up to 128 characters can be stored in the character generator.

The mode of representation of the cursor can be set by the program for each of the two display screens. Thus, it can be represented as

a simple underline
a blinking, very bright underline
an inverse, blinking representation of the entire relevant character position.

The standard interface adapter makes possible a connection to the SIF ESER (RYAD). Data-, status-, sense-, and control-registers are provided for the independent operation of maximally eight units of the BSP. It is possible to connect to all channel types of RYAD, i.e. the BSP can be connected to the byte multiplex-, selector-, or block multiplex-channel.

The remaining modules are connected to these four function complexes, which have been presented briefly here, either directly or through the adapters. As can be seen from Figure 1, two processors are used in the BSP.

The keyboard is directly connected to the bus control. The keyboard arrangement corresponds to the keyboard EC 0101-1, which was previously used in RYAD units. In addition, a keyboard group has been provided, which contains elements to operate the connected CPU.

Another six variable function keys, whose significance is always explained in the 24th line of the right display screen, are situated above the alphanumeric keyboard complex.

In principle, two different keyboards are provided:

Latin Keyboard:
This allows the input of Latin upper case and lower case letters, numbers, and special characters.

Cyrillic-Latin Keyboard:
In this design, it is possible to input Cyrillic and Latin capitals, numbers, and special characters.

An interchange is possible at any time without great effort. Regardless of the design of the keyboard, all keys which initiate control-, erase-, and program-functions have the same lettering and in particular in accord with the abbreviations customary in the operating system.

The maintenance panel and the clock are likewise connected directly to the bus control. As was already the case with the EC 7069, the maintenance panel is affixed in covered fashion. But it contains only a minimum number of operating elements. The maintenance functions are generally exercised, with the BSP, through the keyboard and the display screen. Thus, the maintenance panel contains only

the changeover switch for the entire operating mode
the keys for triggering the initial microprogram loading and for test functions
the error indicators for the logic and the power supply
the changeover switch exchanging the display screen displays.

The clock is quartz-controlled and is buffered through a battery, so that even when the BSP is switched off, the clock continues to run. On the display screen, the hours and minutes are in principle represented as digits, and the seconds as a blinking dot. In the switched-off state of the BSP, there is consequently no display. The clock time and the time can be stored through an internal control of the BSP. This can be useful, for example, when error messages, detected power-line disturbances, or other important events are to be recorded on the working floppy disk for subsequent evaluation.

The operating panel is connected partly with the bus control but partly to the CPU, directly through the system power supply interface.

It is situated below the monitors and comprises

the emergency switch for the entire EDP system

the operating and indicator elements of the central power supply control with the associated key switch

the key switch for ON-OFF-LINE

the key switch to allow or prohibit the CPU maintenance functions

the indicator elements for "OFF-LINE", "NOT CONNECTED", "DEVICE CHECK".

The series printer Robotron 1154 with continuous fan-fold equipment Robotron 1160 has been provided as the printer.

Its printing speed is as follows:

≤ 45 characters per second during continuous operation or respectively
≤ 25 characters per second during start-stop operation.

The maximum writing width is 132 characters and the printable characters comprise

26 upper case letters Latin
31 upper case letters Cyrillic
10 numbers and
25 special characters.

The floppy disk drives EC 5074-01 are mainly used to load the microprograms of the BSP and of the connected CPU. The two drives can be used alternatively. Through a special maintenance mode, it is also possible to write on the floppy disks through the SIF RYAD. The storage capacity of these disks is about 300 K bytes per disk.

A possibility is provided to double the floppy disks. The power supply of the BSP, including a special monitoring and control section, is housed in a panel.

This monitoring and control section guarantees the proper switch-on and switch-off as well as the tolerance monitoring of the various logic voltages. When the BSP is switched off because one of these tolerances has been exceeded, or because of other faults of the operating voltages, special circuit measures guarantee that the fault display remains preserved.

The special interface (SPIF) of the BSP is the same as that of the BE EC 7069. Thus the BSP can also be connected to the EC 2655.

4. Functional Aspects

With the use of two monitors, it is possible simultaneously to display 3,840 characters on the display screen. It is thus possible to display simultaneously information which should be accessible directly and without change of picture, and to structure this display in a clear form.

Switches which are situated on the maintenance panel can interchange the information that is displayed on the display screen, i.e. the right display screen will now display the information of the left one and vice versa. This has the great advantage that, even if one monitor breaks down, one can continue working without

restriction since, now as before, all the pictures can still be displayed. The organization of the display screens will be explained below, starting from the basic position:

Left Display Screen

This display screen is accessible under a device address (depending on the configuration in the display screen/printer- or typewriter-mode).

Here, all 24 lines are available for the program picture. By activating keys, one can cause the picture to change to operating and display pictures (similar to the EC 7069), or one can cause a return to the program picture.

Right Display Screen, Upper 12 Lines

This region is accessible under a second device address in the typewriter-mode.

Alternatively, the following are shown in this region:

Internal maintenance and auxiliary information of the BSP (maintenance mode)
The configuration picture (in the "OFF-LINE" state)
Operating pictures for CPU access (HS displays and the like).

Right Display Screen, Lower 12 Lines

This region has a fixed format. It is used to represent the following complexes:

Interpretation of the "variable function keys"
Status of the keyboard
Time of day
Status of the units (display screens, printer, etc.)
Internal error messages
Conditions in the connected CPU.

The keyboard is switched over between the two monitors by control keys. The cursor display indicates the monitor to which the keyboard has been assigned.

The configuration of the BSP at the SIF RYAD can be set in the "OFF-LINE" state through the configuration picture. The configuration can be independently adjusted for the two monitors and the printers. With the configuration input, unallowable configurations are detected and are rejected.

When transferring from "OFF-LINE" into the status "ON-LINE" or upon special keyboard request, the configuration is stored on the floppy disk.

This configuration, which is stored on the floppy disk, is automatically set up again and the BSP is switched on, after loading the microprograms.

The confiration possibilities are presented below:

Left Monitor
- OFF-LINE
- Display screen/printer mode
- Typewriter mode

Right Monitor, Upper 12 Lines
- OFF-LINE
- Typewriter model with 12 lines, 80 characters each

Printer
- OFF-LINE
- Buffered mode (1,920 characters print buffer)
- Unbuffered model (corresponds to the display screen/printer mode printer with EC 7069)
- Typewriter mode, left monitor
- Typewriter mode, right monitor.

In the typewriter-mode operating mode, the printer is assigned to the respective display screen. But this configuration is accepted only when the corresponding monitor is likewise in the typewriter operating mode.

If such is not the case, the configuration is rejected.

A special organization is the basis for the formatting of the floppy disks that are used as data media. This organization makes possible optimal utilization of the storage capacity. Consequently, only one floppy disk is needed for the microprograms of the EC 2655M and the MAMO.

The character inventory which can be processed by the BSP comprises the complete RYAD system alphabet, i.e.

- Latin upper case and lower case letters
- Cyrillic upper case letters
- Numbers and special characters.

Coming from the I/O channel, all characters contained in the system alphabet are accepted.

Lower case letters are represented on the printer in principle as upper case letters. This is not the case, however, in the display screen representation. Here, the BSP offers the possibility, by further configuration control, of displaying

- only upper case letters analogous to the printer
- Latin upper case and lower case letters
- Cyrillic upper case letters
- and the numbers and special characters.

The transmission to the channel takes place in the mode of the particular information representation.

An extensive system of test routines is available for the internal diagnostics of the BSP. At the same time, a maintenance system has also been implemented, which makes it possible for the engineer to obtain information concerning the status of the BSP as well as its preceding history, and to test the device terminals extensively. The following means are provided for hardware trouble-shooting, that is the localization of defects in a faulty BSP:

Circuit measures in the logic circuitry for using the character evaluation ROM-resident test routines
Plug-in diagnostic adapter for elementary test runs
Direct indication of hard errors on the maintenance panel and, where appropriate, acoustic alarms.

Besides the ROM-resident test routines, further programs can be loaded from the floppy disks.

The modular organization of the logic circuitry and the internal test precautions on the individual function complexes results in further facilitations.

To control the diagnostic process, the operating panel is primarily used in combination with the keyboard and the display screen.

Advantages of the Operating and Service Processor EC 7069M as Compared to the Operating Unit EC 7069

The modular multi-microprocessor structure, the available RAM storage capacity of maximally 96 K bytes, and the use of two floppy disk drives permit a very flexible deployment. Adaptation to the variable requirements of the CPU is thus possible.

Extensions or adaptation to other CPU's of the RYAD can be effected by adding or exchanging functional complexes or modifying the microprograms.

Due to the use of two monitors, there are significant advantages especially in terms of operation:

The individual pictures are designed more clearly and more informatively. The displays are presented in clear text or in intelligible mnemonics;

Clarity is improved. More information can be displayed at the same time. In particular, the possibility is utilized of showing extensive information concerning the CPU simultaneously with the displayed program picture (e.g. display of conditions, instruction counter hours, settings of the address comparison stop equipment, etc.);

The system messages can be divided between two independent regions;

The internal maintenance functions can be executed through the display screen and keyboards;

If one monitor breaks down, work can continue without significant down time; in particular, the scope of the displayed information remains intact through appropriate measures.

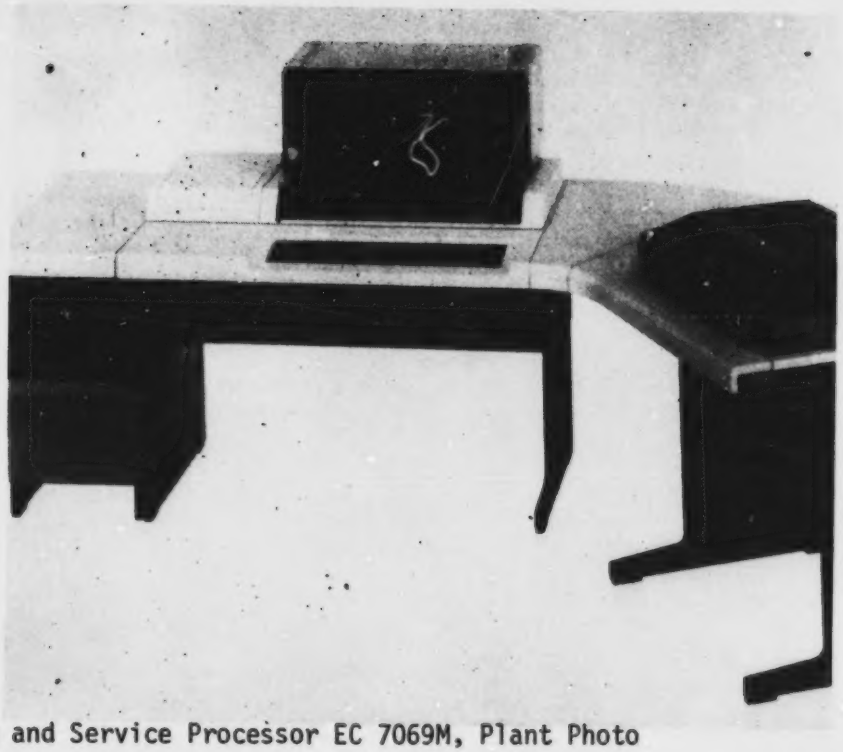
The more extensive diagnostic and maintenance measures as well as precautions for utilizing character evaluation in case of a fault guarantee more efficient troubleshooting and thus shorter down times.

When producing a hard copy, i.e. printing out a display picture, it is possible at any time to determine the beginning and end of the copy through the cursor position or by depressing a key. In many cases, this results in considerable time savings.

The clock offers not only the advantage that, when the EDP system is switched on, or when beginning a new program, the clock time can be interrogated by simply depressing a key and can be transmitted to the CPU, but also offers the possibility of storing in the floppy disk error information together with the clock time, for subsequent evaluation.

Reliability has been significantly increased.

Operating and Service Processor EC 7069M, Plant Photo



Operating and Service Processor EC 7069M, Plant Photo

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CSO: 2302/4

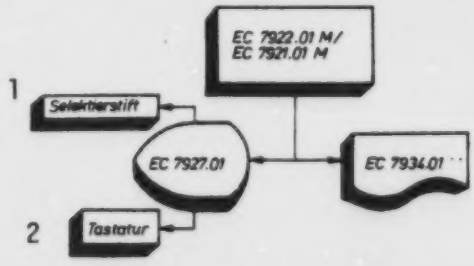
EC 7920M DISPLAY SYSTEM FOR EC 1055M COMPUTER DESCRIBED

Description of System

East Berlin RECHENTECHNIK-DATENVERABEITUNG in German
Vol 18 No 2, Feb 81 pp 11-17

[Article by Dr Peter Anke, VEB Robotron ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 7920M Display Systems"]

[Text] The display screen system EC 7920M is an alphanumeric communication system with applications in many areas of the national economy. Application opportunities exist especially in the area of data acquisition and for tasks which can be accomplished only in conversational mode with an EDP system. The display screen system EC 7920M consists of a display screen unit EC 7927.01, the printer EC 7934.01M, the display screen station 7925.01M, and the device control units EC 7927.01M (remote connection) as well as EC 7922.01M (local connection). The display screen unit and the printer have the same separation point for connection to one of the device control units through a single-stranded coaxial cable with a maximum length of 1200 m. Up to 32 display screen units and/or printers can be connected to one device control unit. For start-up and for testing the system configuration, it is necessary to connect a display screen unit. The remaining 31 connections can be occupied in an arbitrary configuration. All devices of the display screen system 7920M have available a buffer memory of 1920 characters. As regards the connection of the EC 7920M to an EDP system of the ESER (RYAD), one basically distinguishes three configurations: the local display screen system EC 7020.01M, the remote display screen EC 7920.11M, and the remote display screen station EC 7925.01M. Figure 1 shows the universal connection possibilities.



1 selection pencil
2 keyboard

1. System Description of the Display Screen System EC 7920M

1.1 Field Concept

Information consists of a number of independent data elements. Each of these data elements has its own characteristics, which determines the further processing.

With previous display screen systems of RYAD, the information was exchanged for data sets, whose contents and characteristics corresponded to the capabilities of the data processing system. Data elements thus could be transmitted not individually but only as components of a data set. This entailed considerable redundancy in data transmission.

In contrast to this, the display screen system EC 7920M takes into account the handling of individual data elements, which henceforth will be designated as fields. This becomes possible since each of these data elements is defined by the content, length, and position within the entire information that is to be exchanged, that is it has its own characteristics. User operation with individual fields permits data transmission to be restricted to the absolutely necessary fields and thus significantly increases efficiency and facilitates operation by using tabular input directives. As a result, input reliability is also improved.

A field is delimited by two so-called attribute symbols. The introductory attribute symbol determines the characteristic of the associated field.

Besides the length, which is specified by the position of the attribute symbol, the code of the attribute system can specify the following additional properties of the associated field:

Protected or unprotected

If the field is protected, the operator cannot change its content. Protected fields are, for example, headings, formats, titles, requests to the operator for input. All those fields are specified as unprotected which are provided for inputting or changing information by the operator. These are also called input fields.

Alphanumeric or numeric

All letters, numbers, and special characters can be inputted in an alphanumeric field. With a numeric field, a numeric keyboard interlock automatically limits the assortment of characters that can be inputted.

Not displayable and not printable, displayable with normal brightness and printable, and displayable with intense brightness and printable

The specification "not displayable and not printable" is used when data should not be displayed on generally visible display screens or should not be printed on printers for reasons of secrecy.

A more intense brightness is necessary to emphasize important information or to call attention to an error condition.

Selectable with the selection pencil or not

Selectability of a field with the selection pencil greatly facilitates operation. From a large number of prescribed alternative responses, one or more can be prepared for transmission to the EDP system merely by touching with the selection pencil.

Selected or not selected for transmission to the EDP system

A field counts as "selected for transmission to the EDP system" if data are inputted into the field by the operator or if the field data have been changed. This selection is achieved by touching a selectable field with the selection pencil. Prepared input data are characterized in the attribute symbol by the so-called MDT bit. Subsequently, only those fields are transmitted to the EDP system whose MDT bit has been set to "1" by this preselection.

The attribute symbols can be transmitted only by write commands from the EDP system to the display screen. They are not displayed or printed and cannot be changed by keyboard inputs and by the selection pencil. The MDT bit is an exception.

If a display screen display is divided into various fields by the attribute symbols, this display is called formatted.

In the case of an unformatted display, the positions on the display screen can be chosen freely. This corresponds to the mode of operation with display screen units that have previously been used in RYAD.

1.2 Display Screen Unit EC 7927.01

1.2.1 Display Screen Display

The display format of the display screen unit EC 7927.01 is 24 lines with 80 characters each, corresponding to the capacity of the buffer memory. The alphanumeric characters generated by the keyboard or by the problem program can be displayed within unformatted or formatted (field concept) displays. The data input of the operator is supported with a position mark, the cursor, which is shown on the display screen. The cursor is represented by a blinking line underneath the character position, into which the next character is to be inputted through the keyboard.

It is possible to position the cursor through the cursor control keys or through the problem program.

1.2.2 Status Indicators

To check the data input and the communication with the EDP system, the display screen unit has four status indicators.

The switched on indicator SYSTEM AVAILABLE provides information concerning the availability of the system for a new data input.

The indicator INPUT BLOCKED is switched on if data input is blocked through all input devices.

If the display screen unit is put into the "insertion" mode through the keyboard, the indicator INSERTION MODE is switched on.

Fault conditions in the power supply are indicated by DAMAGE.

1.2.3 Keyboard

Four keyboards can optionally be connected to one display screen unit:

Operator station keyboard EC 0101-1.01

This consists of an alphanumeric keyboard (Cyrillic and Latin alphabet) with function keys, and of a block of 12 program function keys.

Data acquisition keyboard EC 0101-1.02

This is composed of an alphanumeric keyboard (Cyrillic and Latin alphabet) with function keys, five program function keys, and one digital keyboard block.

Typewriter keyboard EC 0101-1.03

This consists of an alphanumeric keyboard (Cyrillic alphabet) with function keys and of a keyblock with 12 program function keys.

Latin keyboard EC 0101-1.04

This is composed of an alphanumeric keyboard (Latin alphabet) with function keys, and of a keyblock with a digital keyboard, combined with 12 program function keys.

The Latin keyboard has lower case letters in the upper position and the typewriter keyboard has lower case letters in the lower position. By activating the changeover keys cБ and φcБ, the operator station keyboard and the data acquisition keyboard can also input lower case letters.

The following description of the most important keyboard functions is based on the Latin keyboard EC 0101-1.04 (Figure 2).

Alphanumeric Keys

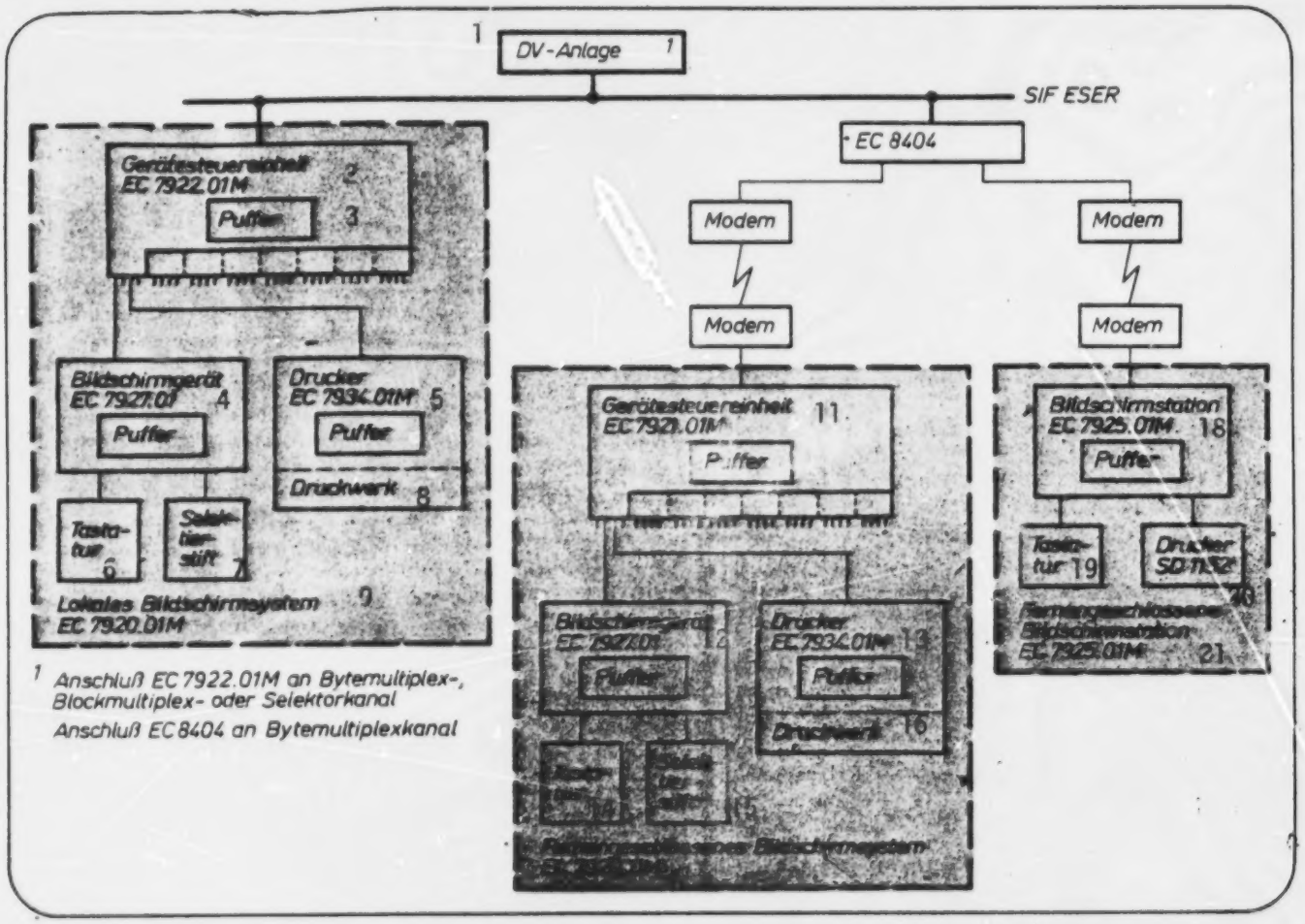
Depending on the changeover keys, the alphanumeric keys are used to input upper case and lower case letters, digits, and special characters. The inputted characters are displayed at the cursor position. The cursor is then moved ahead in the writing direction by one position. After the next to last position in the display screen display has been inputted, an acoustic signal will sound.

Program Attention Keys

The activation of every program attention key causes an input search (henceforth called an I/O message). The differences between these keyboards are coded in the message

identification symbol (AID). The AID is a component of the message that is being transmitted to the EDP system.

The transmission of the data which have been inputted by the operator is reported by means of the "input" (ENTER) key. The program function keys PF1 and PF12 act like the "input" key. However, here it is possible to provide additional information to the problem program by the key-specific coding of the AID. For example, inputted data can be made available to purposefully selected program sections for evaluation.



1 Anschluß EC 7922.01M an Bytemultiplex-, Blockmultiplex- oder Selektorkanal
Anschluß EC 8404 an Bytemultiplexkanal

Figure 1. Connection possibilities of the display screen system EC 7920M

Figure 1 - key

1 EDP system[1]
2 device control system EC 7922.01M
3 buffer
4 display screen unit EC7927.01
5 printer EC 7934.01M
6 keyboard
7 selection pencil
8 print mechanism
9 local display screen system EC 7920.01M
10 SIF RYAD
11 device control unit EC 7921.01M
12 display screen unit EC 7927.01
13 printer EC 7934.01M
14 keyboard
15 selection pencil
16 print mechanism
17 remote connected display screen system EC 7920.11M
18 display screen station EC 7925.01M
19 keyboard
20 printer SD 1152
21 remote display screen station EC 7925.01M

[1] EC 7922.01M connected through a byte multiplexer or selector channel
EC 8404 connected through a byte multiplexer channel

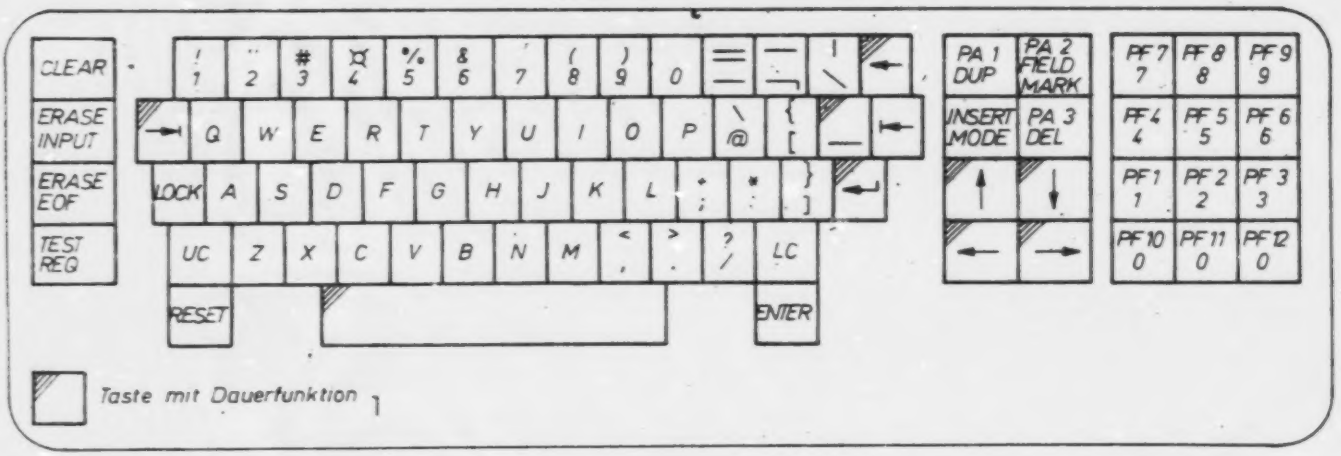


Figure 2. Latin keyboard EC 0101-1.04

1 key with continuous function

The activation of the program access keys PA1 through PA3 now causes transmission of the respective AID to the EDP system. The use of these keys makes it possible for the operator, for example, to begin conversational mode operation, to guide this in a particular direction, or to interrupt it, without additional information needing to be inputted to the keyboard.

The key "test request" (TEST REQ) initiates transmission of a test request message to the EDP system.

The key "total erase" (CLEAR) causes erasure of the entire buffer content.

Erase Keys

Besides the above-mentioned "total erase" key, there are three other erase keys that are adapted to the field concent. These erase keys make it much easier for the operator to input data and altogether to work in the conversational mode. The key "erase input area" (ERASE INPUT) causes erasure of the character positions of all the input fields including the MBT bit. The use of this key is particularly effective when working with tabular input prescriptions. In this case, the inputted data, which have already been transmitted to the EDP system, are erased, and the cursor is positioned at the first input position, to prepare a new input.

The key "erase to the end of the field" (ERASE EOF) is used to erase all characters in an unprotected field beginning with the cursor position up to the next attribute symbol. The parts of individual input fields can thus be erased.

When the "erase" (DEL) key is activated, the character at the cursor position in an unprotected field will be erased. A left shift by one position of the character to the right of the cursor is associated with this. By means of this key, corrections necessitated by a wrong input can be performed without any problem.

Further Function Keys

The key "insert mode" (INSERT MODE) permits the subsequent insertion of characters into an already inputted text. Beginning at the insert point, all characters are right shifted by one position.

The key "duplicate" (DUP) causes input of the symbol DUP and motion of the cursor to the first character position of the next unprotected character field. This key is used, for example, in connection with tabular input prescriptions. If there are successive inputs, and if the values in certain input fields do not change, the operator need not input these values several times, but he merely activates the "duplicate" key, and the problem program inserts the previously received value into this field.

By activating the key "field mark" (FIELD MARK), the symbol FM is inputted into an unprotected field. An application example for this key is the separation of several data blocks of variable length within one input field. The key "reset" (RESET) is used to establish a defined basic state. The keys "upper case" (UC), "lock upper case" (LOCK) and "lower case" (LC) are provided for changing over the corresponding keyboard position.

Cursor Control Keys

The cursor control keys ("to the right" (→), "to the left" (←), "backspace" (←), "upwards" (↑), and "downwards" (↓)) are used to move the cursor in the direction shown on the key. The key "tabulation" (→|) is mainly used after a successful input, to r-ach the first position of the next input field.

The key "new line" (←|) moves the cursor to the beginning of the next line.

The key "back tabulation" (|←) causes the cursor to move to the first character position of the preceding unprotected field. If, before this key is activated, the cursor is in an unprotected field other than in the first character position, the cursor is moved to the first position of the same unprotected field. These keys offer significant aids to the operator in connection with using the field concept. Advantages, in particular with respect to input reliability, arise through the highly specific guidance of the operator during data input.

1.2.4 Switches and Controls

Besides the power switch, the brightness control, and the contrast control, the display screen unit EC 7927.01 has available an operating lock (key switch). In the OFF position, no further data is stored in the buffer of the display screen unit indicated, except for the cursor whose display has already been switched on by the power switch. Data input is blocked, and the display screen unit is unavailable. This prevents unauthorized persons from having access to the display screen system and thus to the programs and files of the EDP system.

The display screen unit becomes available only when the power switch and the operating lock are both switched on.

1.2.5 Numerical Keyboard Lock

To increase safety, e.g. in the acquisition of numerical data, one uses the numerical keyboard lock in combination with the field concept. This device guarantees that no alphanumeric characters, other than digits, commas, periods, minus, and DUP can be keyed into an input field that has been designated as numeric. If there is an attempt to input characters other than those mentioned above, the keyboard is locked. The numerical keyboard lock can be switched off by means of the change-over keys UC and LC.

1.2.6 Selection Pencil

Use of the selection pencil leads to great facilitation for the operator, especially with the rapid input of alternative data that are prescribed by the problem program. The selection pencil input, however, presupposes the use of the field concept.

A field that can be selected with the selection pencil is defined by an appropriately coded attribute symbol, which must be followed by an identifier (?,>, space, or NUL) and than at least one alphanumeric character. In the three last character positions of a selectable field, there must be stored a space or NUL character.

By touching with the switched-on selection pencil, the operator can specify one or more selectable fields for input to the EDP system.

Depending on the identifier of the selectable field, touching with the selection pencil causes the following operations:

If the identifier was a space or NUL character, an I/O message is generated immediately, and the input equipment is locked.

If the identifier was a "?", a ">" is displayed as the new identifier. The field is then indeed selected for transmission to the EDP system, but there is no I/O message.

If the identifier was a ">", a "?" is displayed as the new identifier. Erasure of the MBT bit is associated with this.

The change of identifiers in a display serves the operator as an optical check of his successful selection.

If the input was faulty, the operator can reverse the accomplished selection by renewed touching with the selection pencil.

With all other identifiers, the selection pencil has no effect.

For all the fields that have been selected with the selection pencil, only the addresses and not the contents of the fields are transmitted to the EDP system. This means that the problem program must know the content of the selectable fields, so that the addresses can be linked with the corresponding text. However, it is also possible to have a combined input for the selection pencil and the keyboard. In this, the I/O message must be initiated with the key "input" or with one of the program function keys.

1.2.7 Acoustic Signalling Equipment

The acoustic signalling equipment generates a brief tone when the operator inputs a character into the next to last display position of the display screen or if the problem program arranges this, for example to inform the operator concerning the progress of the conversational mode operation.

1.3 Printer EC 7934.01M

The printers of the display screen system EC 7920M are used to print documents either as a copy of the data shown on the display screen or in correspondence with the printed output indicated by the problem program.

The character inventory of the printer EC 7934.01M comprises 96 characters (Latin and Cyrillic capitals, digits, and special characters). The printing speed is max 50 characters per second. The printer has a buffer memory with a capacity of 1920 characters.

Printing begins after data transmission to the printer and after the instruction for the start of printing from the device control unit.

The advantages of the field concept also apply to the printing operation. For this reason, before printing a check is made whether the line being printed contains attribute symbols, NUL- and DEL-characters, or characters of non-printable fields. These characters are then treated as the "space" character (SP).

The print format is communicated to the printer through the write control symbol WCC or through the copy control symbol CCC. Accordingly, the WCC or the CCC specifies the printable line length either at 40, 64 or 80 characters per line (fixed line length) or the print orders "new line" (NL) and "end of message" (EM) control the line print (variable line length). The print order NL causes line advance, and the print order EM terminates the print operation.

Another print order is the "form forward" (FF). This initiates a form advance to the next STOP for vertical tabulation.

1.4 Display Screen Station EC 7925.01M

The display screen station EC 7925.01M can be connected through modems to the multiplex control unit EC 8404. Multipoint or point-to-point connections are used for communication between the display screen station and the EDP system.

The display screen station consists of a display screen unit comparable to the EC 7927.01, including a numerical keyboard lock and acoustical signalling equipment as well as a mobile connectible keyboard.

Three keyboard variants are available, the Latin, the Cyrillic-Latin, and the Cyrillic keyboard, which have a more advantageous arrangement of some function keys as compared to the keyboard variants of the EC 7927.01. Connection of the series printer SD 1152, as a desk top unit, is possible as an option. The length of the printed line is 80 characters, corresponding to the length of the lines on the display screen. The print copy of the display screen contents can be started by the operator through the keyboard.

Compared to the EC 7927.01, the EC 7925.01M offers the following improvements in application:

The additional orders "roll up" (RU), and "roll down" (RD), and "new writing line" (NWL) facilitate programming with the advantage of saving transmission time.

The possibility of inputting orders, addresses, and attribute symbols through the keyboard permits the definition of fields and formats, by means of the display screen unit.

Additional function keys, such as "insert a line" (INS LINE), "delete a line" (DEL LINE), and "change over the key function" (CTRL) as well as "start printed copy" (REC) increase the functional scope.

1.5 Device Control Units

1.5.1 Device Control Unit for Local Connection EC 7922.01M

The device control unit, in its basic design, has available connections for four display screen units EC 7927.01 and/or printers EC 7934.01M. Through a maximum of seven terminal adapters, each with four terminals, a total of 32 display screen units and/or printers can be connected.

The device control unit controls the execution of commands received from the channel of the EDP system. If no command operation takes place, all the devices are interrogated by the device control unit to determine the current device status. Detection of an I/O message leads to a report to the EDP system.

If a device is addressed by the EDP system, the device control unit stops its cycling device interrogation and provides information concerning the current status of the addressed devices. If the device status permits, the device control unit performs the indicated command operation with this device.

When a write or read command first begins to be executed, the entire buffer content is transmitted from the addressed device to the device control unit. When a read command is executed, the device control unit transmits the data read by the device to the EDP system.

When a write command is executed, the data in the device control unit are modified corresponding to the command and are subsequently transmitted to the device.

1.5.2 Device Control Unit for Connection of the EC 7921.01M

The explanations in Section 1.5.1 apply to the connection possibilities for the units EC 7927.01 and EC 7934.01M, the command operations and the cyclic device interrogation.

On the basis of algorithms of remote data transmission, the device control unit is addressed by special data sequences, is interrogated, and is controlled with commands. In contrast to the EC 7922,01M, an I/O message which comes from a connected unit and which has been detected in the device control unit can be transmitted to the EDP system only after a general interrogation of the device control unit, instigated by the problem program, after a special interrogation of the device, or by a read command. For data transmission between the device control unit 7921.01M and the multiplex control unit (EC 8404) connected to the channel, appropriate modems must be connected as the transmission rate indicates.

2 Organization of the Data Exchange Between an EDP System of RYAD and the Display Screen System EC 7920M

2.1 Commands

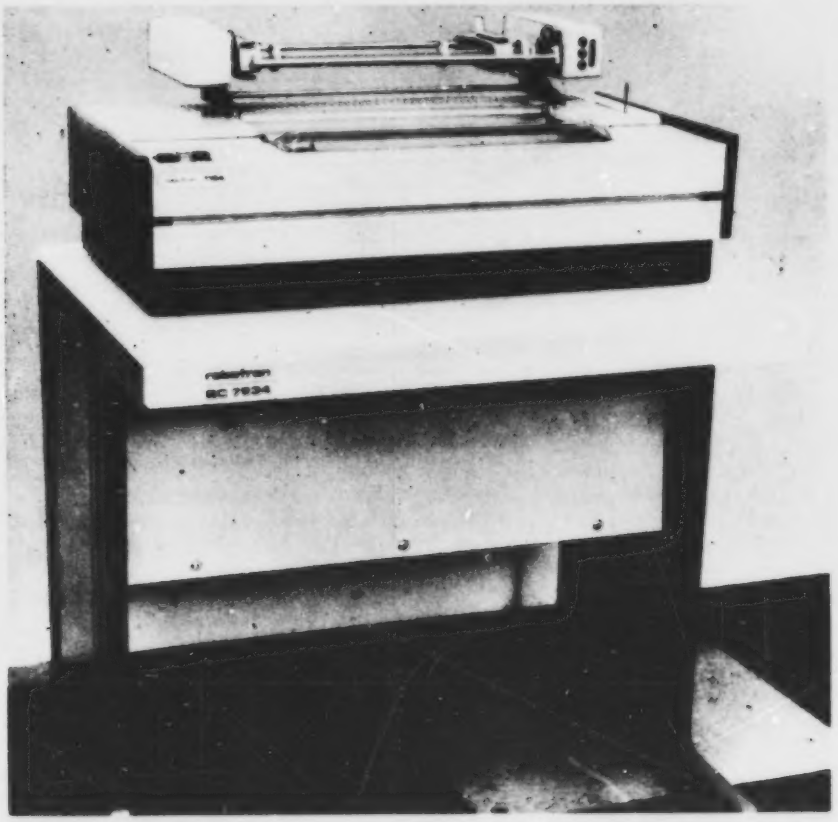
2.1.1 Write Commands

The commands "write" and "erase/write" are used to load, format, and selectively erase the device buffer data.

Display screen EC 7927.01

The command "erase/write" first causes the complete erasure of the device buffer and subsequently the writing of alphanumeric characters in dependence on the concommitantly transmitted orders. This command is used to establish a defined basic state on the display screen. Examples for this are the beginning of conversational mode or if a complete overwriting of the previously displayed information is not possible by a new display.

In contrast to this, the use purpose for the "write" command is a partial modification of the display screen display, especially when working with tabular input prescriptions.



Printer EC 7934.01M

2.1.2 Read Commands

The read commands "read buffer" and "read modified" are used to transmit to the EDP system the information displayed on the display screen.

The command "read buffer" causes transmission of all data of the device buffer including NUL characters and orders. It is predominantly used for diagnostic purposes.

The read command that is mainly used is "read modified". The read operation being executed refers only to such data fields as were modified by the operator of the display screen unit by means of the keyboard or the selection pencil, that is those fields in which the attribute symbol has the MBT bit set. This results in high efficiency for data exchange when using the command "read modified", since

only alphanumeric characters of the fields which the operator has modified through the keyboard can be transmitted (the data are always identified through the concomittantly transmitted address of the first alphanumeric character),

all blanks are suppressed in the transmission,

only the addresses of the modified fields (no alphanumeric data) are transmitted if the input has been effected with the selection pencil (the alternate responses are already known to the program),

no addresses and alphanumeric data are transmitted to the EDP system if the input has been initiated by one of the three PA keys or through the key "total erase" (the message is identified through the AID symbol).

2.1.3 Control Commands

Besides the commands "control without effect", "sense" and "test I/O", whose function are already known and which are executed only by EC 7922.01M, the user of the display screen system also has available the following control commands:

The command "copy" is executed only by the EC 7921.01M. It can be used to transmit data between two devices connected to the same EC 7921.01M. Here, the selected device is the device to which the data are to be transmitted. The address of the source device is a component of a so-called copy data sequence. The advantage of this command, in terms of the application, consists of the fact that the content of the display screen can also be displayed on other display screen units and/or can be copied on printers without the functions of the EDP system being required for data transmission. This simultaneously implies a decisive reduction of load on the transmission networks and a reduction of transmission time.

The command "select" is executed only by the EC 7922.01M. It causes solely the transmission of the buffer content from the selected device to the device control unit. In this way, the execution time of the commands "write", "read modified", and "read buffer" is shortened and altogether a time unburdening of the channel of the EDP system is achieved.

The command "erase all unprotected fields" is executed by both device control unit types. This command requires the use of the field concept and is used to prepare a new input in input prescriptions. This results in significant facilitation for the operator and in an improvement of input reliability through the implementation of the following functions:

Erasure of all alphanumeric characters in all unprotected fields by entering NUL characters

Resetting the MBT bit of all unprotected fields

Release of the keyboard

Resetting the I/O message in the display screen unit

Positioning the cursor to the first character position of the first unprotected field.

After these operations have been automatically executed, a new input process can begin.

2.2 Orders

In addition to the above-mentioned print orders NL, EM, and FF, there are also orders in the display screen system EC 7920M, which are absolutely necessary for application of the field concept. These are control characters and control character sequences, which are transmitted in between alphanumeric data in write and read data sequences. These orders are used to define fields, to position and erase data, and to control the cursor.

The order "start field" (SF) announces, in a data sequence, an attribute symbol as the next character.

The order "set buffer address" (SBA) sets up a new buffer address that can be selected by the user, beginning at which a write operation is to be started or continued or beginning at which other orders are to be executed. In a read data sequence, this order advances the first alphanumeric character of a modified field in connection with the command "read modified".

The order "set cursor" (IC) causes the setting of the cursor at the location at which the next alphanumeric character is to be written into the buffer. This order represents a significant input aid, since the cursor can be positioned by the problem program at the first character position of the first input field.

The order "programmed tabulation" (PT) sets the current buffer address to the position of the first alphanumeric character of the next unprotected field. Furthermore, in the normal case, this order erases all positions, beginning at the current buffer address and up to the end of the field.

The order "character repetition up to address" (RA) contains a character which is written in repeatedly, beginning with the current buffer address until the address specified in the order sequence has been reached (exclusively). This is particularly useful when transmitting a large number of similar alphanumeric characters, e.g. special characters for the visual organization of tables.

The order "erase unprotected field up to address" (EUA) writes NUL characters into all unprotected positions, beginning at the current buffer address up to the address specified in the order sequence. However, the order does not change the attribute symbols of the respective unprotected field.

2.3 Control of the Local Display Screen System EC 7920.01M through the RYAD Channel

Communication betweeen the channel and the device control unit EC 7922.01M takes place on the basis of the operational principles of RYAD.

Initiated through an instruction START I/O, the channel in accord with the channel program being executed, controls the operations in the device control unit through information that is being transmitted through the RYAD standard interface. The device control unit informs the channel of the central unit through the status byte concerning the statuses existing in the selected device, in various phases of command operations or even when no command operations are being executed.

2.4 Control of the Display Screen System EC 7920.11M

The remotely connected display screen system EC 7920.11M communicates with the problem program through modems, transmission lines and a multiplex control unit (EC 8404).

A synchronous data transmission system (BSC) is utilized. Transmission takes place in two-sided semi-duplex operation through a four-wire dedicated line. The control algorithm utilized corresponds to the operating mode for multipoint connections.

At the beginning of an operation with the display screen system an instruction START I/O addresses the multiplex control unit in a transmission line, but, because of the operating mode of the multipoint connection, not the device control EC 7921.01M. The channel commands are executed in the multiplex control unit. These are not commands for the display screen system EC 7920.11M.

The device selection and the command operations with the devices of the display screen system EC 7920.11M are implemented with the following transmission procedures.

With interrogation addressing, three different addressing sequences must be distinquished:

The special interrogation addresses one EC 7921.01M and a connected device or an EC 7925.01M. If data are ready for transmission to the EDP system, a read operation is executed as with the command "read modified".

The general interrogation addresses only one EC 7921.01M for the step-by-step testing of every connected device. Data which are ready are transmitted to the EDP system in the sequence of interrogation. For this purpose, only one read operation always takes place as with the command "read modified".

Diagnostic interrogation is used for checking whether the connection with the EC 7921.01M or the EC 7925.01M has been established.

The selection addressing selects a device or an EC 7925.01M which is connected to the EC 7921.01M, for subsequent execution of a command. After the selection addressing has been performed, a command sequence can be emitted by the EDP system.

3. Program Support

The program support of the display screen system EC 7920M is secured by the components BTAM, TCAM, the message scheduler, and the CRJE in the operating system OS/ES, Edition 6.1. Support through the access method BCAM in the operating system DOS/ES is provided in Version 1.74. Furthermore, the user must do some programming work, however, whose scope depends on the particular problem. This programming work begins with the specification of information which is to be exchanged between the problem program and the operator of the display screen unit. This information is to be arranged according to the rules of the field concept in the form of pictures. It here proves suitable to enter this information, including the attribute symbols, on form sheets (24 lines with eight columns each) corresponding to the desired display-screen display.

A row/column code can now be entered into another form sheet for every attribute symbol and for every order. The subsequently transmitted buffer address of a display-screen unit or of the printer will be determined from this.

Finally, a program is coded which causes display of the information on the display screen and which processes the operator inputs. This program consists of a few assembler statements and represents a connecting element between the problem program and the access method. The assembler statements comprise hexadecimal codes for all orders and attribute symbols, the associated buffer addresses, as well as the text being transmitted.

4. Advantages in Using the Display-Screen System EC 7920M

Compared to the display-screen technology previously used in RYAD, the display screen system EC 7920 offers the user a large number of advantages.

It facilitates operation and increases reliability during data input. These advantages are guaranteed by the following functions:

Due to a purposeful arrangement of fields on the display screen, the field concept makes possible data input by way of tabular input prescriptions.

Through the programmable display brightness, priorities can be created for treating the displayed information.

Alternative information prescribed by the problem program can be selected for transmission to the EDP system by means of the selection pencil (no keyboard operation required).

Because the keyboard functions are optimally adapted to the field concept (e.g. tabulation, erasure, insertion), only a few operating steps are required.

The programmable setting of the cursor makes it possible to guide the operator during data input.

The numerical keyboard lock prevents input of non-numerical data in certain fields.

An acoustic signal calls the operator's attention to certain conditions, on which further operator actions depend.

An operations lock prevents unauthorized persons from having access to the display screen units and thus the programs and files in the EDP system.

The application possibilities are expanded by the following features:

a larger display capacity (1920 characters)

several keyboard variants adapted to the problem

display-screen units and printers within one configuration, which can be set up locally and remote

the possibility of expanding a local or remote device control unit from four to 32 connections

association of one or more printers with one or more display-screen units

data transport from one display-screen unit to another one or to a printer, initiated by the operator or by the problem program.

The following features increase the efficiency of data exchange:

suppression of irrelevant characters (e.g. erased locations or successive similar characters) during data transmission,

addressing of individual buffer positions and thus the possibility of writing and reading data selectively,

reading information exclusively from fields which were modified by the operator during input,

program-controlled erasure of all data in input fields through the transmission of individual command codes and orders,

programmable tabulation after data output with the erase function up to the end of the field.

1979 Performance Specifications for the EC 7920(M)

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German
Vol 16 No 11, Nov 79 back cover

[Back cover series on "EDP-Equipment", signed "He.": "EC 7920(M) Display System"]

[Text] Technical Data: Device control unit EC 7921.01 (M) and EC 7922.01 (M)

Connection to the central unit

	EC 7921.01	EC 7922.01
Connection picture	I 2 (CCITT V 24) with modem and MPD	SIF RYAD
Code	KOI-7	DKOI
Data transmission rate	9600 bit/s	maximal 380 kbyte/s
Connection distance	according to postal lines	maximal 60 m
Connection from the EC 7927.01 and EC 7934 (M)		
Device interface	KIF EC 7920	
Number of device connections	maximally 32, in steps of four similar connections	
Code	14 bit code (system internal)	
Data transmission rate	864 k bit/s	
Maximum connection distance	1200 m	
Connection to the line	220 V + 10 percent/- 15 percent	
Line frequency	50 Hz + 1 Hz	
Power consumption	about 300 W	
Dimensions	750 x 1200 x 400 mm	

Display screen unit EC 7927.01

Device interface	KIF EC 7920
Display screen capacity	1920 characters
Character inventory	128 characters
Keyboards	possibility of four keyboard types
Dimensions	460 x 468 x 600 mm desk-top unit
Weight	about 56 kg
Power consumption	about 165 W

Printer EC 7934.01 (M)

Device interface	KIF EC 7920
Character inventory	displays 84 characters
Printing output continuous	45 characters/s
Printing output start-stop	25 characters/s
Line width	132 characters
Paper equipment	continuous fan-fold equipment

This system makes available universally useable communications stations. Their application for directed acquisition and conversational mode operation is possible in nearly all areas of the national economy in combination with the data processing systems of the RYAD.

The system consists of the device control units for remote and local connections, of the display screen units, and of autonomous printers, which are connected to the device control unit.

Device control unit for remote connection EC 79.21.01 (M)

The device control unit controls data exchange between an EDP system of the RYAD and the decentrally disposed display screen units and printers. On the computer side, the connection takes place through modem - multidata transmission lines - modem - multiplexer with synchronous connection control - EDP system of the RYAD; on the device side, the connection is made through the small interface (KIF) EC 7920 to the display screen units and the printers.

Thirty-two terminal devices (display screen units or printers) can be connected; however, at least one display screen unit must be included. For expanding the connection, supplementary equipment is available for four connections. Since the device control unit can be expanded with a maximum of seven supplementary devices, the connnection of maximally 32 terminal devices is possible.

Main functions:

Detecting and responding to received addressing sequences from the computer

Controlling operations which are necessary to execute commands transmitted from the computer to the device control unit

Verifying the current status of the terminal devices, such as readiness, completion of the command operation, I/O message or errors in the device - when all the command operations have been executed.

Device control unit for local connection EC 7922.01 (M)

The device control unit controls data exchange between an EDP system of the RYAD and locally disposed display screen units and printers. On the computer side, the connection is made through SIF RYAD to a selector-, multiplex-, or block multiplex-channel (RYAD II) and, on the device side, through the IF EC 7902 to the display scrren units and printers. On the device side, 32 terminal units can also be connected to this device control unit, where the same considerations hold as were noted for the device control unit EC 7921.01 (M).

Main functions:

Controlling and monitoring the interface channels

Controlling the operations which are necessary to execute commands transmitted by the computer to the device control unit

Verifying the current status of the terminal units after completion of the command operations.

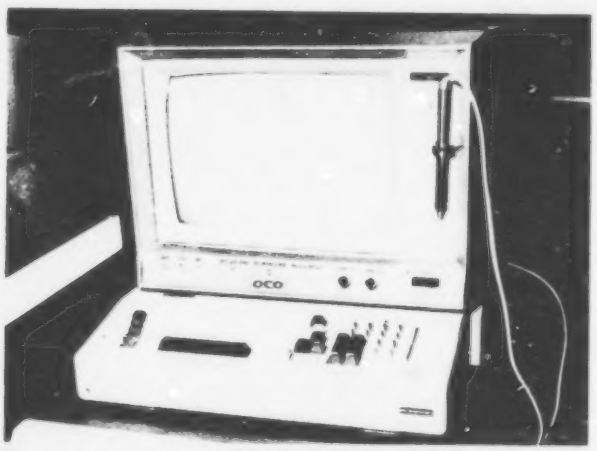


Photo of the EC 7927.01 (M)

Display Screen Unit EC 7927.01 (M)

The display-screen unit (photograph) is used to input and output information in conversational mode with an EDP system of the RYAD through device control units for remote and local connections.

The display-screen unit is designed as a desk-top unit. Its basic variant is composed of the alphanumeric display screen and the keyboard.

An operations lock, an acoustic signalling device, and a numerical keyboard lock are contained in the basic equipment. As supplementary equipment one can connect a selection pencil.

The display-screen unit has a buffer memory of 1920 characters and can reproduce 24 lines with 80 characters each.

Printer EC 7934 (M)

The printer, as an autonomous desk-top unit, can be coupled with device control units for local and remote connections.

The printer is used for making copies of display screen data (printable data of the buffer) and for the print output of data which are transmitted by the EDP system through write commands connected with a write control character (or copy control character in the case of a remote set-up).

8348
CSO: 2302/4

EC 7902M HARDWARE STATION FOR EC 1055M COMPUTER DESCRIBED

Performance Specifications

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German
Vol 18 No 5, May 81 back cover

[Back cover series on "EDP Equipment", signed "Roe": "EC 7902M hardware station"]

[Text] Technical data:

Power consumption: 1.3 kW
Weight: 260 kg
Paper tape unit 1:
information input rate: 300 characters per second
information output rate: 50 characters per second
data medium: paper tape, five or eight track
Paper tape unit 2:
information input rate: 1000/500 characters per second, convertible
information output rate: 50 characters per second
data medium: five track or eight track paper tape
Cassette unit:
tape speed: V_1 = 19 cm/s V_2 = 38 cm/s
transmission rate: 0.75 k bytes/s or 1.50 k bytes/s
tape transport function: forward/backwards; fast tape transport forwards and backwards with v ≈ 1.5 m/s; rewind with v ≈ 1.5 m/s
number of tracks per cassette: 2
testing possibilities for the information: read-after-write
data medium: digital cassette after ISO 3407

The equipment station EC 7902M is an I/O unit with a standard connection picture SIF ESER (RYAD) for paper tape and magnetic tape cassettes as data media. This unit replaces the paper tape station EC 7902. The expansion concerns the input and output possibilities through a cassette. There are two equipment variants:

EC 7902M1 - paper tape technology and cassette technology

EC 7902M2 - paper tape technology

The variant EC 7902M1 will be made available at a later stage.

Equipment station EC 7902M

The equipment station is built in standardized rack technology. The inserts or racks, from top to bottom, comprise the following:

the operating panel with the device control unit and the power supply
the first paper tape unit
the second paper tape unit
a pull-out storage compartment
the cassette unit
the maintenance panel with the power and channel connection.

The paper tape units with various device power each comprise a paper tape reader and puncher with control electronics and with the power supply necessary for this. The cassette unit consists of two drives and the power supply. With the equipment variant EC 7902M2, this module is omitted.

The device control unit guarantees the channel connection and the connection control of the three device insert modules. It is microprocessor-controlled and works with microprograms for the individual function complexes. After switch-on, an internal microtest automatically tests all the essential functions of the device control unit.

Each device of the equipment station has its own device address. It is possible that all six devices work quasi-simultaneously with the channel in multiplex operation. Duplicating and comparison of paper tapes is possible in off-line operation.

The technical program support of the equipment station is furnished within the framework of an expansion of Edition 6.1 of the OS/ES.

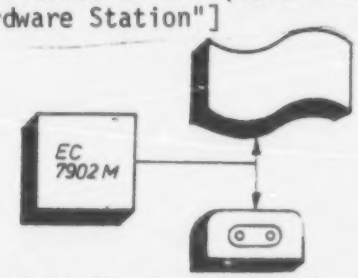
Besides new functional capabilities, the following features increase the utility for the user as compared to the previous paper tape station EC 7902:

higher reliability by using the most modern components
lesser space area for the equipment (reduced from about 1.5 m^2 to about 0.5 m^2)
lower weight (about 268 kg in place of 325 kg)
a smaller volume (reduced from 1.45 m^3 to about 0.8 m^3).

Description of EC 7902M Equipment

East Berlin RECHENTECHNIK-DATENBERARBEITUNG in German
Vol 18 No 2, Feb 81 pp 18-19

[Article by Manfred Roeger, VEB Robotron ZFT (Center for Research and Technology), Karl-Marx-Stadt: "EC 7902M Hardware Station"]



[Text] The equipment station EC 7902M is an I/O unit with the standard connection picture SIF RYAD for paper tape and magnetic tape cassettes as data media. This unit replaces the paper tape station EC 7902. The expansion concerns input and output capabilities to the cassette. There are two device variants:

EC 7902M1 - paper tape technology and magnetic tape technology

EC 7902M2 - paper tape technology.

The variant EC 7902M1 will be furnished at a later stage.

Besides the new functional capabilities, the following features increase utility for the user as compared to the previous paper tape station EC 7902:

Higher reliability by using the most modern elements
A smaller base area for the equipment (reduced from about 1.5 m^2 to about 0.6 m^2)
A smaller weight (about 260 kg in place of 325 kg)
A smaller volume (reduced from 1.45 m^3 to 0.8 m^3)

1. Structure of the Equipment Station

The equipment station (Figures 1 and 2) is built in standardized rack technology. The inserts or racks, from top to bottom, comprise the following:

the operating panel with the device control unit and the power supply
the first paper tape unit
the second paper tape unit
a pull-out storage unit
the cassette unit
the maintenance panel with the power and cable connections

The paper tape units with various device power each comprise a paper tape reader and puncher with control electronics and with the necessary power supply. The cassette unit consists of two drives and the power supply. With the device variant EC 7902M2 the latter module is omitted.

The device control unit guarantees the channel connection and the connection control of the three device modules. It is microprocessor controlled and works with micro-programs for the individual function complexes. After switch-on, an internal micro-test automatically tests all the essential functions of the device control unit. Each device of the device station has its own device address. It is possible that all six devices operate quasi-simultaneously with the channel in multiplex operation. Duplicating and comparing the paper tapes is possible in off-line operation.

The technical program support for the device station will be furnished within the framework of an expansion of Edition 6.1 of the OS/ES.

2. Paper Tape Units

2.1 Paper Tape Unit 1

The paper tape unit is built as an insert module according to the modular principle. The full interchangeability of the individual modules is guaranteed by adhering to the prescribed tolerances. The paper tape unit uses five track or eight track standard paper tapes.

The speed of the paper tape reader in run-through operation is 300 characters per second and in start-stop operation maximally 100 characters per second. The transport track and information tracks are scanned photoelectrically in the see-through method.

The output rate of the puncher is about 50 characters per second. The paper tape is punched mechanically. An electric checking device is present for detecting punching errors. The module must be pulled out of the cabinet for inserting a new roll of paper tape into the punch.

2.2 Paper Tape Unit 2

This paper tape unit belongs amongs the fast paper tape units. It makes possible a reading speed of 1000/500 characters per second and a punching speed of 50

characters per second. The paper tape reader can be switched over from one speed to the other. Start-stop operation is possible. The paper tape unit uses five track or eight track paper tape. The module must be taken out of the cabinet to insert a new roll of paper tape into the punch. The paper tape reader likewise works after the photoelectric principle in the see-through method.

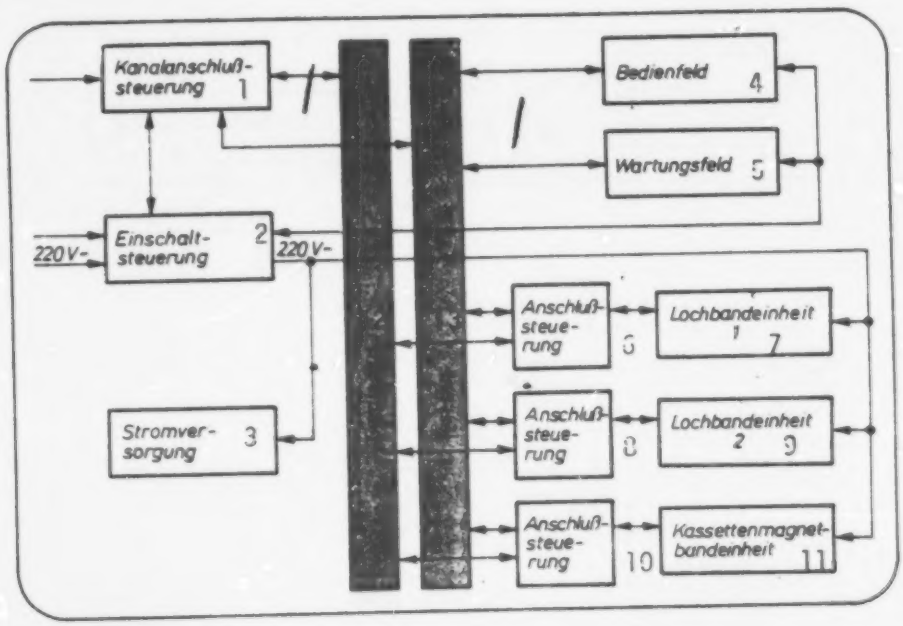


Figure 1. Block circuit diagram of the device station EC 7902M1

1 channel connection control
2 switch-on control
3 power supply
4 operating panel
5 maintenance panel
6 connection control
7 paper tape unit 1
8 connection control
9 paper tape unit 2
10 connection control
11 cassette unit
12 device bus
13 test bus

3. Cassette Unit

The cassette unit consists of two cassette devices in one module. The cassette unit contains a three-motor drive with control electronics. It can be used in a combined recording-playback unit. The tape speed is 19 and 38 cm/s forwards and backwards. With fast tape transport, the tape speed is 1.5 m/s forwards and backwards for an evaluatable analog signal. The digital cassette after ISO 3407 (tape width 1/8 inch) is used as the data medium. The device works with phase-encoded recording with a bit density of 32 bits/mm.

4. Operating and Indicator Elements

The operating panel on the front plate of the uppermost insert module of the equipment statement can be subdivided into three function complexes:

Basic status indicator/operation
Device selection and assignment
Uniform operating panel corresponding to the assignment

The first complex contains on/off keys and the technical error indicator. By means of the second complex (device selection key with indicator, intervention necessary indicator), the corresponding operating elements of the uniform operating panel are assigned to a particular device. By means of the keys, indicators, and rotary switches of the uniform operating panel, all the remaining necessary indicator and operator functions can be implemented.

Besides the operating panel of the equipment station, each device insert module also contains specific operating and indicator elements.

5. Maintenance Panel

The maintenance panel, which can be tilted out and which is housed in the lowermost insert module, guarantees the handling of maintenace tasks and of trouble-shooting with high efficiency. Among other things, it comprises a main switch, a switch for the power supply control, keys for selecting the micro-test runs, indicators for selected registers, temperature monitoring indicators and damage indicators.

Figure 2. Technical parameters of the equipment station

Power consumption	1.3 kW
Weight	260 kg
Paper tape unit 1:	
information input rate:	300 characters/s
information output rate:	50 characters/s
data medium:	paper tape five or eight tracks
Paper tape unit 2:	
information input rate:	1000/500 characters/s, convertible
information output rate:	50 characters/s
data medium:	paper tape, five or eight tracks

Cassette unit:	
tape speed:	V_1 = 19 cm/s; V_2 = 38 cm/s
transmission rate:	0.75 k byte/s or 1.50 k byte/s
tape transport functions:	forwards/backwards; fast tape transport forwards and backwards with v ≈ 1.5 m/s; rewind with v ≈ 1.5 m/s
number of tracks per cassette:	2
test possibilities for the information	read-after-write
data medium:	digital cassettes after ISO 3407

8348
CSO: 2302/4

MATRIX MODULE FOR EC 2655, EC 2655M CENTRAL UNITS DESCRIBED

East Berlin RECHENTECHNIK-DATENVERARBEITUNG in German
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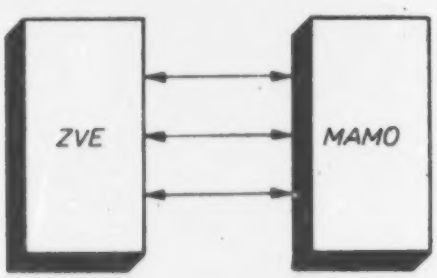
[Article by Roland Geissler, Mathias Riesen, Friedhelm Seifert, VEB Robotron ZFT (Center for Research and Technology), Dresden; Dr Rolf Gruner and Klaus Wendlik, VEB Robotron ZFT, Karl-Marx-Stadt: "Matrix Module"]

[Text]



For the central unit (CPU) EC 2655 and EC 2655M there is a special computing unit (matrix module or MAMO for short) which is offered as supplementary equipment. The MAMO cannot be connected to other central units of ESER (RYAD).

The selection of the implemented algorithm was made with the objective of making possible, for the widest possible range of users, a considerable speed up in job processing.

The important application areas are the following:

seismic data processing
optical calculations
input processing
the energy business
building statics
optimization problems of the electronics industry
research problems
statistics of the national economy
meteorology
eigenvalue problems

The performance capabilities of the MAMO field instructions is greater by a factor of < 70 compared to the corresponding assembler programs on the EC 2655. The high parameter flexibility of the MAMO field instructions permits effective tailoring to numerous user problems. Besides the performance aspects, the great simplification of user programs through the use of MAMO instructions is an important feature for the user. Altogether, 28 MAMO field instructions are made available to the user for solving problems.

1. Connection and Basic Operating Mode of the MAMO

Some special processors, e.g. IBM 2938 and IBM 3838, are operated within the EDP system like an I/O unit over the I/O system.

Studies have shown that the introduction of powerful special functions alone satisfies only a portion of user needs. In practice, special functions are nearly always imbedded in a context of universal processor instructions and/or programs.

Finally, the execution time of the total special problem is of interest to the user and not the execution time of an isolated special function, i.e. to solve a problem with special functions, a device solution must be found which reduces to a minimum the explicitly necessary organizational effort for completing the task (operating system and, in some cases, monitor programs). But associated with this are also those properties which help to simplify the programming work, such as

use of virtual storage,
simple linkage of special functions to the program which are formulated in higher programming languages.

Furthermore, aspects of the effective further development of the device solution must also be considered. These aspects permit reliable utilization of progress in the area of system architecture and computer technology.

For the anticipated functional scope and for the expected application areas, a linkage of special functions as an extension of the instruction spectrum of the universal processor has turned out to be the most effective solution. Figure 1 shows that the MAMO is connected as a computer unit extension through a three-component special interface (1, 2, 3). The MAMO consists physically of a RYAD cabinet including the power supply.

Data exchange from the MAMO data buffer, through the storage adapter, with main storage (MS) takes place through the component interface 1. The data paths have a double-word width. The storage adapter handles either CPU access (CPU = central processing unit) or MAMO access. The particular requests that are handled depend on a MAMO mode trigger. When activity changes, this trigger is switched over by a CPU microprogram. The MS access to the channel complex has basic priority.

The component interface 2 permits direct control data exchange between the computer unit of the CPU and the control complex of the MAMO. The control functions are executed through this interface. These are used to start, to continue interrupted MAMO instructions. and to terminate algorithmic MAMO execution sequences. The access information (addresses, etc.) for MS access of the MAMO are likewise contained therein.

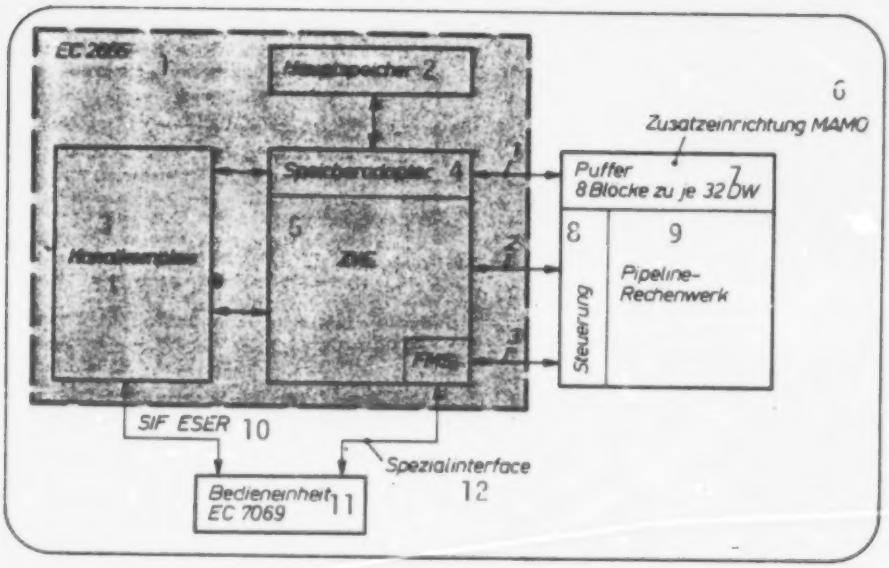


Figure 1. Connection of the matrix module through a three-part special interface

1 EC 2655
2 main storage
3 channel complex
4 storage adapter
5 CPU
6 supplementary device MAMO
7 buffer, eightblocks with 32 DW each
8 control
9 pipeline computer unit
10 SIF RYAD
11 operating unit EC 7069
12 special interface

Component interface 3 is used for diagnostics and for service-operator controls through the operations unit EC 7069 or the operating and service processor (BSP) EC 7069M. All three component interfaces work synchronously with a timing cycle of 380 ns.

The CPU executes several standard functions for the supplementary computing unit MAMO, e.g.:

Preparation and decoding of instructions
Starting algorithmic execution sequences in the MAMO
All types of MAMO instruction terminations
Machine error evaluation corresponding to the RYAD operation principles
Organization and supervening control of all diagnostic processes in the MAMO by CPU microprograms
Handling the MAMO-MS accesses
Communication with EC 7069, etc.

Furthermore, all MAMO control instructions are executed by the CPU and all operating conditions of the MAMO are monitored.

The pipeline computer unit in the MAMO, as a high-performance computer unit, is capable, with a short format in the processing (short RYAD floating point numbers), of executing simultaneously 2.5 million additions and 2.5 million multiplications per second.

2. General MAMO-Specific Basic Ideas

2.1 MAMO Instructions

The MAMO is addressed by machine instructions. These represent an extension of the instruction spectrum of the EC 2655. MAMO programs consist of a sequence of CPU and MAMO instructions, all of which run under the control of the same PSW.

All MAMO instructions (Figure 2) have the operation code X'E1'. Through the subcode (UC), they are subdivided as follows:

control instructions (UC = ØØ...7F)
field instructions (UC = 8Ø...FF).

The nine control instructions cannot be interrupted. They are partly privileged. Except for one control instruction, they are implemented in the CPU alone and do not use the MAMO. The field instructions can be interrupted. They are implemented jointly by the CPU and the MAMO. The MAMO here essentially takes over the algorithmic part of the instructions. The field instructions generally process large quantities of data which cannot be described in the instruction itself. Consequently, the address of the second operand (base register B2, shift D2) points to the parameter block (PAB), which contains all the required specifications concerning the data being processed and being generated, as well as other parameters for controlling the MAMO-internal execution sequences. The address of the first operand points to the message block (MIB), in which the MAMO, at the end of an operation, makes available all the necessary information for the user, e.g. communications concerning the generated data or, in the case of termination of the algorithmic task, specifications concerning the cause of the termination.

2.2 Data Kinds and Data Types

In the MAMO field instructions, indices, components, rows, fields, and scalars are processed.

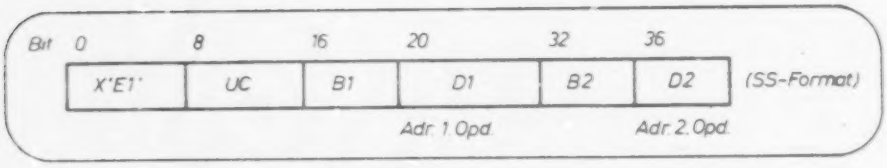


Figure 2. Structure of a MAMO instruction

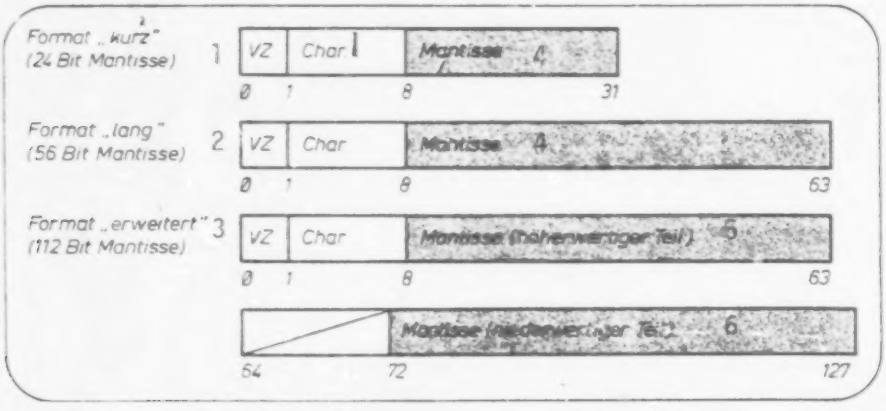


Figure 3. Floating point number with a format corresponding to the RYAD operation principles.

1 format "short" (24 bit mantissa)
2 format "long" (56 bit mantissa)
3 format "expanded" (112 bit mantissa)
4 mantissa
5 mantissa (most significant part)
6 mantissa (least significant part)

An index j is an unsigned fixed point number in the range $0 \leq j \leq 2^{15}-1$.

A component A[i,j] or a[j] is a value (Figure 3) to which an index j can be assigned; here, the row number i lies in the range $0 \leq i \leq 2^{15}-1$.

A row a or A[i] is an ordered set of components of the same format (e.g. a vector); the number of components is called the step number S, $0 \leq SA-1 \leq 2^{15}-1$.

A field A is an ordered set of rows of the same step number and with the same format (e.g. a matrix): the number of rows is called the row number R, $0 \leq R-1 \leq 2^{15}-1$.

A scalar d is a value to which an index cannot be assigned.

The storage of components, rows, and fields can be effected in two different ways:

Non-indexed type of data storage, where only the values are stored

Indexed type of data storage, where the indices associated with all the values of the components are explicitly stored together with said values (in the literature frequently called compact storage).

2.2.1 Non-Indexed Components, Rows and Fields

A non-indexed component A[i,j] consists of a value of the format of the component; the index is not stored; it is implied from the relative address of the storage location of the value, relative to the beginning of the row.

A non-indexed row A[i] consists of non-indexed components A[i,Ø], A[i,1], ... A[i,SA-1]; here, the address of the value of the component A[i,Ø] is called the address of the row Adr. A[i]. The value addresses of the individual components of the rows are determined as follows:

Adr. A[i,j] in bytes: = Adr. A[i] + j*WA*F

j= 0,1,..., SA-1
WA: step width, WA = $\pm$ 1, 2, 4, 8
F = 4 if FA = short
8 if FA = long
16 if FA = extended

In the case of resultant rows, the step width is always $W_C = \pm 1$, i.e. the non-indexed row c is generated by a gapless storing of the values of the components. A non-indexed field A (Figure 4) consists of non-indexed rows A[Ø], A[1],...A[R-1] of the same step width. The address of the row A[Ø], here is called the address of the field Adr. A.

The addresses of the rows in the field are determined by:

Adr. A[i] in bytes: = Adr. A + i*D*F

i = 0,1,..., R-1
D: row distance, Ø $\leq$ D-1 $\leq$ 2expl5-1.

2.2.2 Indexed Components, Rows, and Fields

An indexed component A[i,j] consists of a value of the format of the component and the explicitly stored index j. Components whose value is a true zero may not be stored. Four components, whose value and index are stored explicitly, are always collected together to a component block (Figure 5).

An indexed row A[i] consists of indexed components through gapless linkage of component blocks. Access to an indexed row takes place through the row head RK (Figure 6).

If a row A[i] does not contain explicitly stored components, i.e. all values of the row are zero, one sets YA[i] = Ø.

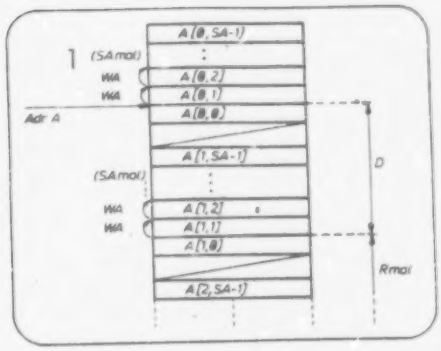


Figure 4. Example of a non-indexed field with WA less than Ø

1 SA times

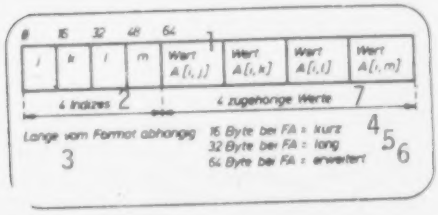


Figure 5. Component block

1 value
2 four indices
3 length of format depends on
4 16 bytes if FA = short
5 32 bytes if FA = long
6 64 bytes if FA = expandèd
7 four associated values

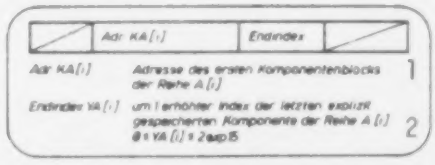


Figure 6. Row head RK

1 address of the first component block of row A[i]
2 final index YA[i]: index incremented by 1, of the last explictly stored component in row A[i], $Ø \leq YA[i] \leq 2exp15$

An indexed field A (Figure 7) is obtained by the linkage of the row heads of the indexed row A[Ø], A[1],...A[R-1], where the address of the row A[Ø], i.e. the first row head, is called the address of the field Adr. A. The addresses of individual rows, i.e. of the row heads, of the field are determined as follows:

Adr. A[i] in bytes: = Adr. A + i*8

i = Ø, 1, ..., R-1

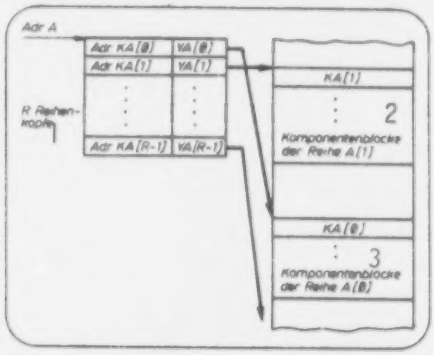


Figure 7. An example of an indexed field

1 R row head
2 component blocks of the row A[1]
3 component blocks of the row A[Ø]

2.3 Parameter Block PAB

The parameter block PAB comprises the required specifications concerning the data structure as well as the specifications for processing the data in the MAMO (Figure 8).

Depending on the particular field instructions, various double words (DW) are undefined, e.g. for scalar d DW5, for operand b DW4, etc.

Besides the specifications for the data structure, such as the addresses Adr. A, b, c, d, the step numbers SA-1, Sb-1, the row number R-1, the DW2-5 of the PAB also contains the parameters step width WA, Wb, Wc, type TYA, TYb, TYc, as well as the format FA, Fb, Fc, Fd. As another parameter, the sign transformation BZTA, VZTb, VZTc, VZTd can be selected. The sign transformation (Figure 9) offers the possibility of processing the components of a row, of a field, or of a scalar, with a different sign than is given in the MAMO, or to store them with a different sign than the calculated one.

Through the options specified in DW1, the processing of MAMO instructions can be modified and/or can be expanded by additional functions:

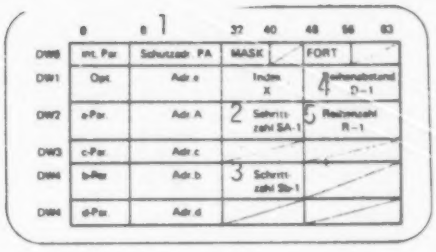


Figure 8. Structure of the parameter block PAB

1 protection address PA
2 step number SA-1
3 step number Sb-1
4 row distance D-1
5 row number R-1

Figure 9. Sign transformation

VZT	Processing or output
00	value
01	- value
10	|value|
11	- |value|

Option 1 - reset the write address
Option 2 - test the resultant component
Option 3 - store explicit zeroes
Option 4 - search a resultant component

Option 1 is effected when one tries to store something at the protection address PA, specified in the DWØ, in main storage. This causes the algorithmic exception condition SO. When option 1 is chosen, and if the interrupted field instruction is continued, the double word whose writing into MS was prevented by SO, is written at the original Adr. c or Adr. Kc. The other components of the resultant row are written in sequence. The user must save the storage region in MS before continuation of the field instruction.

Option 2 makes possible:

substitution according to a barrier,
search for extremal values.

With substitution according to a barrier e (address Adr. e in DW1), the values W of the resulting components, which fulfill the substitution condition, are replaced by a true zero of the same format, or the magnitude of the value is replaced by the magnitude of the barrier (Figure 10).

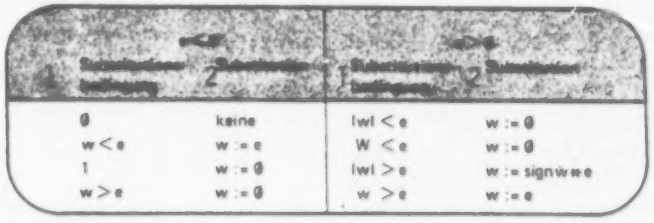


Figure 10. Substitution corresponding to a barrier

1 substitution condition
2 substitution

With a search for extremal values, the component of the resultant row c[j] is sought, whose value fulfills the search conditions. The following search conditions are possible:

|w| = min |value c[j]|
w = min (value c[j])
|w| = max |value c[j]|
w = maz (value c[j])

Option 3 is effective only when an indexed resultant row is generated. If option 3 is chosen, the resultant components, whose values are to be calculated explicitly, are also stored explicitly (i.e. also components with the value zero).

With option 4, that component c[X] of the resultant row is sought, which is associated with the index X (contained in DW1 of PAB).

In DWØ of the PAB, internal parameters can be specified for processing the operands as well as the mask bit MASK and the continuation bit FORT for handling algorithmic exception conditions.

2.4 Message Block MIB

In the message block MIB, more detailed information is given to the user in the case of a regular end of operation (condition code CC = Ø) or in the case of an irregular termination (CC = 1, 2). The structure of the MIB for CC = Ø is given in Figure 11.

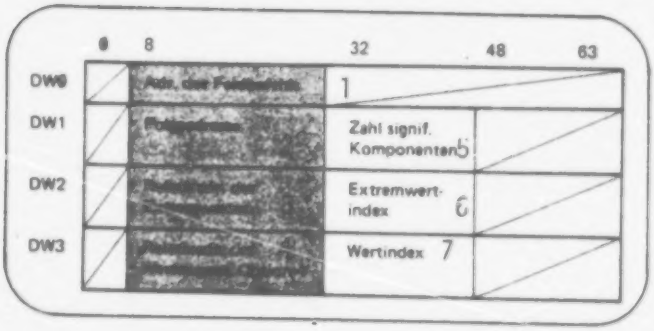


Figure 11. Message block MIB

1 address of field instruction
2 following address
3 relative address of the extreme value
4 relative address of the value according to option
5 number of significant components
6 extreme value index
7 value index

In DWØ, the address of that field instruction is specified, to which the MIB refers. The follower address specified in DW1 points to the next free double word address after the resultant row c. The number of significant components, in the case of an indexed resultant row c, contains the number of explicitly stored components. In the case of a non-indexed resultant row c, it contains the number of components of c whose value is not equal to zero. In DW2 are contained specifications for option 2, and in DW3 are contained specifications for option 4. The specified relative addresses generally refer to the Adr. c of the resultant row.

An irregular termination of a field instruction can occur through the appearance of an algorithmic exception condition (Figure 12). Here, a continuation is possible with the message CC = 1. Through the continuation bit FORT, contained in the PAB, it is possible to specify whether it is intended to continue. With the message CC = 2, continuation is not possible.

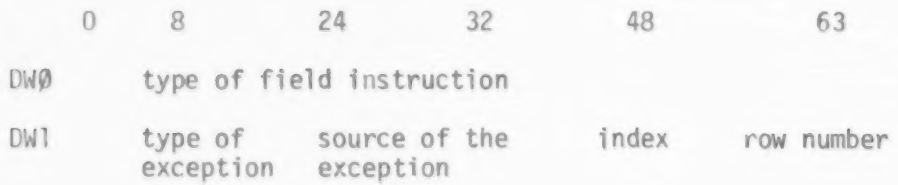
With the mask bit MASK contained in the PAB, the report of certain algorithmic exception conditions can be suppressed. Depending on the exception that has occurred, an entry will be made in the MIB.

In DW1 (Figure 13), specifications are given concerning the kind of algorithmic exception condition as well as references regarding the context (index, row number), through which the exception has been caused.

Figure 12. Algorithmic exception conditions

Type of exception	CC	Explanation
IP	2	Unallowable parameter input in the PAB
NM	2	In an indexed row, the indices do not form a monotonically increasing sequence
SO	1	An attempt was made to write a component of the resultant row at an address which is specified by the protection address PA in the PAB
EOA	2	Exponent overflow during addition, of mantissa = Ø, characteristic > 128
EUA	1	Exponent overflow during addition, i.e. mantissa = Ø, characteristic < 0
LS	1	Mantissa lost during addition, i.e. mantissa = Ø

Figure 13. Type of algorithmic exception conditions



Mnemonic	Designation	Subcode	Short Description
	Row manipulations		
TER	Test row	85	testing the components a [X], a [X+1], ..., a [Sa−1]
RSTR	Restore row	A1	$c[j] := a[j+X]$ $(j = 0,1,\ldots, Sa-1-X)$
URR	Unite row and row	C1	$c[j] := \begin{cases} b[j] & \text{für } j < X \\ a[j-X] & \text{für } j \geq X \end{cases}$ $(j = 0,1,\ldots, Sa-1+X)$
	Row operations		
ARR	Add row and row	D7	$c[j] := a[j] + b[j]$ $(j = 0,1,\ldots, \max(Sa, Sb)-1)$
ARC	Add row and constant	DE	$c[j] := a[j] + b[0]$ $(j = 0,1,\ldots, Sa-1)$
MRS	Multiply row by row	C4	$c[j] := d * a[j]$ $(j = 0,1,\ldots, Sa-1)$
MRSAR	Multiply row by scalar and add row	E7	$c[j] := d * a[j] + b[j]$ $(j = 0,1,\ldots, \max(Sa, Sb)-1)$
MRSARX	Multiply row by scalar and add row from index X	F7	$c[j] := \begin{cases} b[j] & \text{für } j < X \\ d * a[j] + b[j] & \text{für } j \geq X \end{cases}$ $(j = 0,1,\ldots, \max(Sa, Sb)-1)$
MRR	Multiply row by row	C7	$c[j] := a[j] * b[j]$ $(j = 0,1,\ldots, Sa-1)$
MR1	Multiply row by itself	A7	$c[j] := a[j] * \text{abs}(a[j])$ $(j = 0,1,\ldots, Sa-1)$
	Field manipulations		
FRAC1	Form row from array components with given index	A3	$c[j] := A[j, SA-1]$ $(j = 0,1,\ldots, R-1)$
FRACD	Form row from array components in principal diagonal	AA	$c[j] := A[j,j]$ $(j = 0,1,\ldots, \min(R, SA)-1$
EARRVI	Exchange in array rows row values according to indices	A9	$A[j,i] := \begin{cases} A[j,i] & \text{für } i \neq X, \\ & i \neq SA-1 \\ A[j,X] & \text{für } i = SA-1 \\ A[j,SA-1] & \text{für } i = X \end{cases}$ $(j = 0,1,\ldots, R-1)$
ZAVI	Zero array values with given index	89	$A[j,i] := \begin{cases} A[j,i] & \text{für } i \neq SA-1 \\ 0 & \text{für } i = SA-1 \end{cases}$ $(j = 0,1,\ldots, R-1)$

Mnemonic	Designation	Subcode	Short Description
	Field operations		
SMARR	Scalar multiply array row by row	C2	$c[j] := \sum_{i=0}^{\min(SA,Sb)-1} A[j,i] \bullet b[i]$ $(j = 0,1,\ldots,R-1)$
SMARI	Scalar multiply array rows by itself	A6	$c[j] := \sum_{i=0}^{SA-1} A[j,i] \bullet abs(A[j,i])$ $(j = 0,1,\ldots,R-1)$
SRVAR	Sum row values for array rows	B2	$c[j] := \sum_{i=0}^{SA-1} A[j,i]$ $(j = 0,1,\ldots,R-1)$
LCARR	Linearly combine array rows according to row components	E8	$c[j] := \sum_{i=0}^{\min(R,Sb)-1} A[i,j] \bullet b[i]$ $(j = 0,1,\ldots,SA-1)$
SAR	Sum array rows	C8	$c[j] := \sum_{i=0}^{R-1} A[i,j]$ $(j = 0,1,\ldots,SA-1)$
SAVD	Sum values in principal diagonal	BA	$c[0] := \sum_{i=0}^{\min(R,SA)-1} A[i,i]$
	Calculation of polynomials		
CPRV	Calculate polynomial for row values	CE	$c[j] := \sum_{i=0}^{Sb-1} b[i] \bullet a[j]^{exp\,(Sb-1-i)}$ $(j = 0,1,\ldots,Sa-1)$
	Correlation		
COR	Correlation	CF	$c[j] := \sum_{i=0}^{\min(Sa-j,Sb)-1} b[i] \bullet a[j+i]$ $(j = 0,1,\ldots,Sa-1)$
AC	Autocorrelation	AF	$c[j] := \sum_{i=0}^{Sa-j-1} a[i] \bullet a[j+i]$ $(j = 0,1,\ldots,Sa-1)$
CCR	Cyclic correlation	DF	$c[j] := \sum_{i=0}^{s-1} b[i] \bullet a[j+i]$ if $s \leq Sa-j$; $c[j] := \sum_{i=0}^{Sa-j-1} b[i] \bullet a[j+i] + \sum_{i=Sa-j}^{s-1} b[i] \bullet a[j+i-Sa]$, if $s > Sa-j$ $(j = 0,1,\ldots,Sa-1)$, $s = \min(Sa, Sb)$

Mnemonic	Designation	Subcode	Short Description
	FFT, Complex Operations		
FFT	Fast Fourier Transformation	CD	Fast Fourier Transform of the row a into the row c (Sa = 2exp m compl. component) after the algorithm of COOLEY TUKEY
FFTI	Fast Fourier Transformation inverse	DD	
RAFC	Rearrange Fourier coefficients	CC	Rearranging the row a, generated with FFT/FFTI, into the row c, multiplying by the scalar d (Sa = 2 exp m complex comp.)
MRCC	Multiply row by row, complex	C6	c[j]: = a[j] * b[j] (complex) (j = Ø, 1,.., Sa-1; Sa = k*32 compl. comp.)

Figure 14. List of MAMO field instructions (continued from previous two pages)

3. Instruction Spectrum

3.1 List of MAMO Instructions

This list (Figure 14) carries the defined field instructions of the operation code X'E1'. An extension of the instruction list is possible conditionally within the framework of the implemented device technology, through the flexibility of the microprogram control.

3.2 Simple Demonstration Examples

Example 1 (Figure 15): Addition and multiplication of matrices
D = A*B + λ*C
A (Sa,Sb)-matrix
B (Sb,R)-matrix
b_i ith column of B
C (Sa,R)-matrix
c_i ith column of C
D (Sa,R)-matrix
d_i ith column of D
(i = Ø,1....R-1)
λ scalar factor

A,B,C,D - stored by columns.

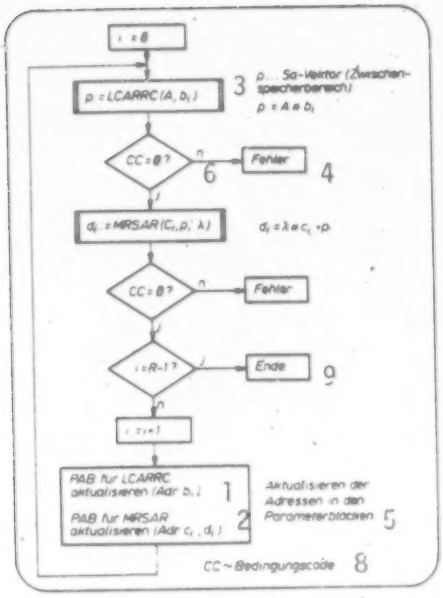


Figure 15. Addition and multiplication of matrices

1 PAB for LCARRC updated (Adr, bj)
2 PAB for MRSAR updated (Adr, cj,dj)
3 p..Sa vector (intermediate storage region)
4 error
5 updating the addresses in the parameter blocks
6 no
7 yes
8 condition code
9 end

Example 2 (Figure 16): Iteration $X^{(k+1)} = A*X^{(k)}, X^{(0)} = X$; terminates if $\max|X_i^{(k+1)} - X_i^{(k)}| < e$
(e ... barrier)
A...(R,R)-matrix
X,X(k)...R-vector
A - stored by rows.

Example 3 (Figure 17): Folding of two rows a, b by means of the Fast Fourier Transform (FFT).
c = f(a,b) a, b, c - rows with Sa = sB = Sc = 2^m components

In the program execution sequence diagrams for the examples, MAMO instructions are identified by [□□□].

Other activities are implemented through CPU instructions.

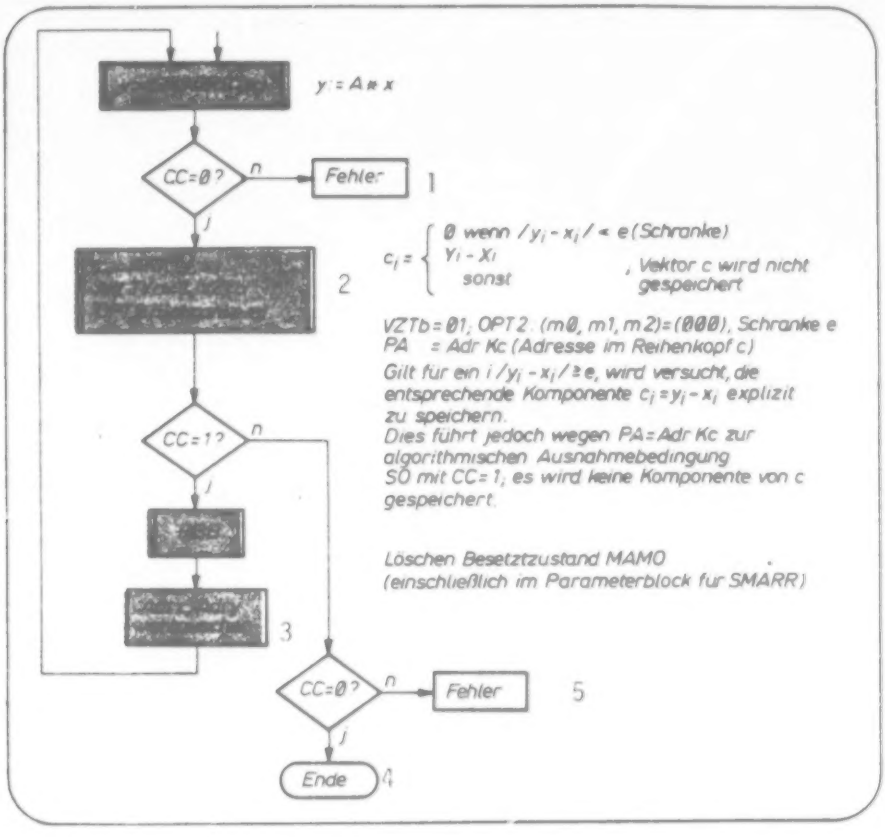

y = A * x
CC=0?
n
Fehler
1
j
2
$c_i = \begin{cases} 0 \text{ wenn } /y_i - x_i/ < e \text{ (Schranke)} \\ Y_i - X_i \\ \text{sonst} \end{cases}$
, Vektor c wird nicht gespeichert
VZTb = 01, OPT 2, (m0, m1, m2) = (000), Schranke e
PA = Adr Kc (Adresse im Reihenkopf c)
Gilt für ein i /yi - xi/ ≥ e, wird versucht, die entsprechende Komponente ci = yi - xi explizit zu speichern.
Dies führt jedoch wegen PA = Adr Kc zur algorithmischen Ausnahmebedingung
SO mit CC = 1, es wird keine Komponente von c gespeichert.
CC=1?
n
j
Löschen Besetztzustand MAMO
(einschließlich im Parameterblock für SMARR)
3
CC=0?
n
Fehler
5
j
Ende
4

Figure 16. Iteration with termination

1 error
2 c: = ARR(y,x) with TYc = 1, VZTb -OPT2 (barrier e)
3 Adrx, Adry interchanged
4 end
5 error

c_i = Ø if /yi - xi/ e (barrier)
Yi - Xi otherwise vector c is not stored

VZTb = 01; OPT 2: (mØ, m1, m2) = (ØØØ), barrier e
PA = Adr Kc (address in row head c)

Holds for an i/yi - xi/ e, an attempt is made to store the corresponding component ci = yi - xi explicitly.

However, because PA = Adr Kc, this leads to an algorithmic exception condition SO with CC = 1: no component of c is stored.
Erase occupation status MAMO (including in parameter block for SMARR).

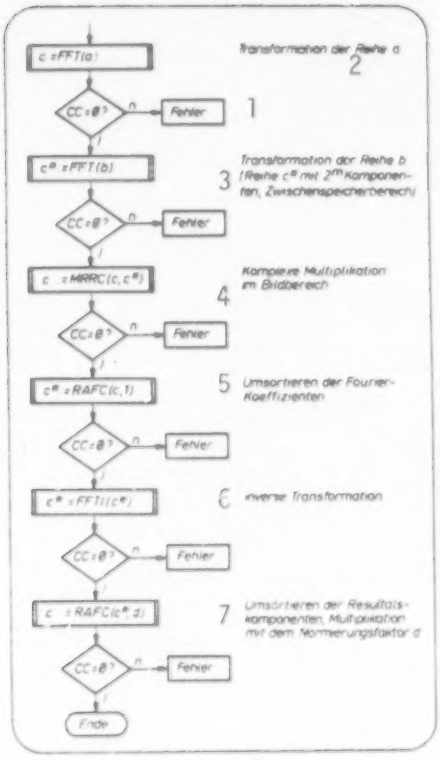


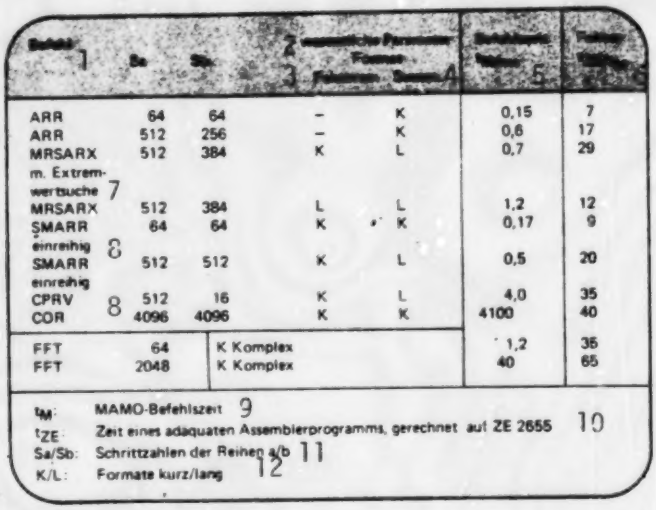
Figure 17. Folding of two rows a, b with the Fast Fourier Transform (FFT)

1 error
2 transformation of row a
3 transformation of row b (row c* with 2^m components, intermediate storage area)
4 complex multiplication in the image area
5 resorting the Fourier coefficients
6 inverse transformation
7 resorting the result components, multiplication with the normalization factor d

3.3 MAMO Instruction Times and Performance Comparison

Because of the manifold parameter influences on MAMO instruction times, an absolute performance specification is inappropriate. Studies have shown that the performance capability of MAMO becomes important beginning at row lengths of about 30.

Figure 18 lists a few instruction times and performance comparisons with corresponding assembler programs (calculated on the CE 2655). Here, examples have been chosen which have considerable importance in application.



Befehl 1	Sa	Sb	2 Wesentliche Parameter: Faktoren 3	Format 4	Befehlszeit 5	Faktor 6
ARR	64	64	–	K	0,15	7
ARR	512	256	–	K	0,6	17
MRSARX	512	384	K	L	0,7	29
m. Extrem-wertsuche 7						
MRSARX	512	384	L	L	1,2	12
SMARR	64	64	K	K	0,17	9
einreihig 8						
SMARR	512	512	K	L	0,5	20
einreihig						
CPRV	512	16	K	L	4,0	35
COR 8	4096	4096	K	K	4100	40
FFT	64	K Komplex			1,2	35
FFT	2048	K Komplex			40	65

t_M: MAMO-Befehlszeit 9
t_{ZE}: Zeit eines adäquaten Assemblerprogramms, gerechnet auf ZE 2655 10
Sa/Sb: Schrittzahlen der Reihen a/b 11
K/L: Formate kurz/lang 12

Figure 18. Instruction times and power comparison with the assembler programs (calculated on the CPU EC 2655)

1 instruction
2 essential parameter
3 factors
4 format
5 instruction time
6 factor
7 with extremal value search
8 one-row
9 MAMO instruction time
10 time of an adequate assembler program, calculated on the CPU 2655
11 number of steps of rows a/b
12 format short/long

4. Global Characteristics of MAMO

4.1 Block Structure

In Figure 19, the MAMO is subdivided into its most important logical complexes. This yields the following groups of complexes:

Central Diagnostic Complex (ZDK):

The ZDK is directly linked with the error response system FMS of the CPU, but sometimes operates completely autonomously. The component interface 3 contains

a special command section, where elementary control commands are transferred to the ZDK from the CPU and from the EC 7069M/EC 7069. Through this connection, the ZDK, within the framework of its wide functional scope, can be completely programmed externally. This basic property, in combination with the novel orthogonal data shift device "diagnostic bus", is a precondition for the extraordinarily good servicing and diagnostic properties of the MAMO. The ZDK does no preprocessing in the sense of the MAMO algorithms.

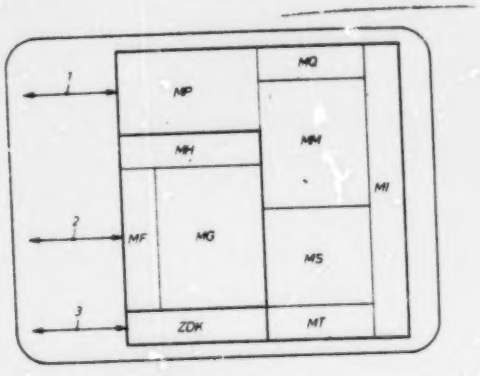


Figure 19. MAMO block structure

Microprogram-Controlled Function Complexes:

MG: MG is the microprogram control unit. By means of it, the following functions are executed:

Controlling the execution sequences in the MH to generate the necessary address calculations for all MS accesses of the buffer and for special control accesses (dynamical microprogram loading).

Controlling the interface procedures of the MF.

Presetting and starting the slave-controlled automatic units.

Evaluating the current operating conditions of the working automatic units.

MF: Implementing the procedures on component interface 2.

MH: Address computing unit for communication between the MAMO and MS.

Logically Controlled Complex

This consists of six rather large logic units which, in conjunction with one another, perform a type of "hand shake" operation. MQ, MM, MS and MT form the processing pipeline, which is controlled by the control unit MI.

MP: The buffer consists of eight blocks, each with 32 double words. The blocks are used dynamically, in alternation as input/output buffers, and work essentially in parallel. Supply accesses of the pipeline and MS traffic are first of all parallelized.

MQ: Data selection control of the pipeline from the buffer.

MM: Multiplication unit

MS: Addition unit

MT: Test unit

MI: Index control unit, which supplies the control "tupel" to the automatic pipeline units.

Figure 20 shows, in stylized fashion, the control levels in the EC 2655/EC 2655M. It is apparent that four control levels become active for processing MAMO tasks; here, a parallelization of the functions sometimes affords considerable performance gains.

4.2 Execution Sequence of a MAMO Field Instruction from the User Perspective

In Figure 21, an attempt has been made to represent in a block diagram the most important activities involved with the execution of a MAMO field instruction.

Block A: Designates a CPU program, which, up to this point, has not yet processed a MAMO field instruction.

Block B: With the decoding of the E1 operation code, represents the beginning of the MAMO field instruction. This function occurs in the instruction preparation unit of the CPU.

Block C: Represents a CPU microprogram which is activated by the E1 instruction code. Its tasks are:

testing the validity of the subcode,
where appropriate, generating the standard program exceptions PRAN (1),
testing the MAMO conditions READY, BUSY, BLOCKED, switching on the MAMO mode,
transfer of the valid subcode to the MAMO and MAMO start.

This CPU microprogram (C) subsequently goes into a special waiting status, where it waits for a message from the MAMO.

In Block D, MAMO processes the desired algorithm. If, during execution of the algorithm, I/O interrupts occur in the CPU because of the MAMO, or if external interrupts occur, or other conditions which require immediate handling by the CPU, a halt request (2) is transmitted from the CPU control to the MAMO.

Thereupon the MAMO terminates its MS access activities, goes over into the busy state, and reports with a halt message (3) to a CPU microprogram, which is represented by block E. This microprogram initiates an operation end of the MAMO

instruction. Subsequently, the CPU handles the interrupt through the activity 4. The activity 3 also occurs, if, during the processing of the algorithm, algorithmic exceptions occur or, during data acquisition by the MAMO access exceptions occur in the MS.

If no halt request exists or if no interrupt exists in the CPU upon termination of the CPU microprogram block E, the next CPU instruction of the active MAMO program is called, which must be a conditional transfer instruction (Block F).

If CC = Ø, the program is continued with the following instruction, which can already again be a MAMO instruction (Block G).

If CC ≠ Ø, there is a transfer to a connection routine (Block I), which is generated when the macro statement MPB (see Section 6.1) is first called, together with the parameter block PAB.

The connection routine establishes the connection to the PRAN handling routine of the user (Block H). The address of the handling routine is located in the parameter block PAB. This principle guarantees that the user can assign his own PRAN handling routine to each group of MAMO field instructions or to an entire MAMO program.

If the PRAN handling routines were able to make good the program damage, a transfer (9) occurs to Block 9, and there the instruction counter status of the interrupted MAMO instruction is reestablished, and a transfer takes place to this instruction (11).

If the PRAN handling routine does not succeed in its task, the activity is returned to the operating system with a program end SVC instruction (8). In the ABEND routine of the control program, the BUSY status of the MAMO is cancelled with the instruction MUC. If no PRAN handling routine has been provided when CC = 1 occurs, the connection routine takes care of the transfer 8 to the operating system. The special treatment of the arithmetic exception in the case of MAMO field instructions leads to a significant speed-up of this procedure, since the path via the operating system is avoided. In the processing of data fields, the PRAN handling can occur with great frequency (e.g. loss of mantissa, exponent underflow). A repair possibility in this case consists in the fact that the corresponding resultant components are replaced by true zeroes.

4.3 Servicing and Diagnostics

The MAMO is serviced through the operating unit EC 7069 or the BSP EC 7069M. The individual functional units of the MAMO are functionally displayed through special servicing pictures.

The most important registers, counters, control triggers are displayed in standard form. Every MAMO service picture contains a variable section in the lower picture area, through which one can display every further MAMO trigger through a certain display address. Since the MAMO has available an orthogonal data shift device, namely the diagnose bus, all MAMO triggers can be set to an arbitrarily selectable value for test purposes, in pulsed cycle or pulse phase operation. All these manipulations take place from the servicing unit or from the BSP.

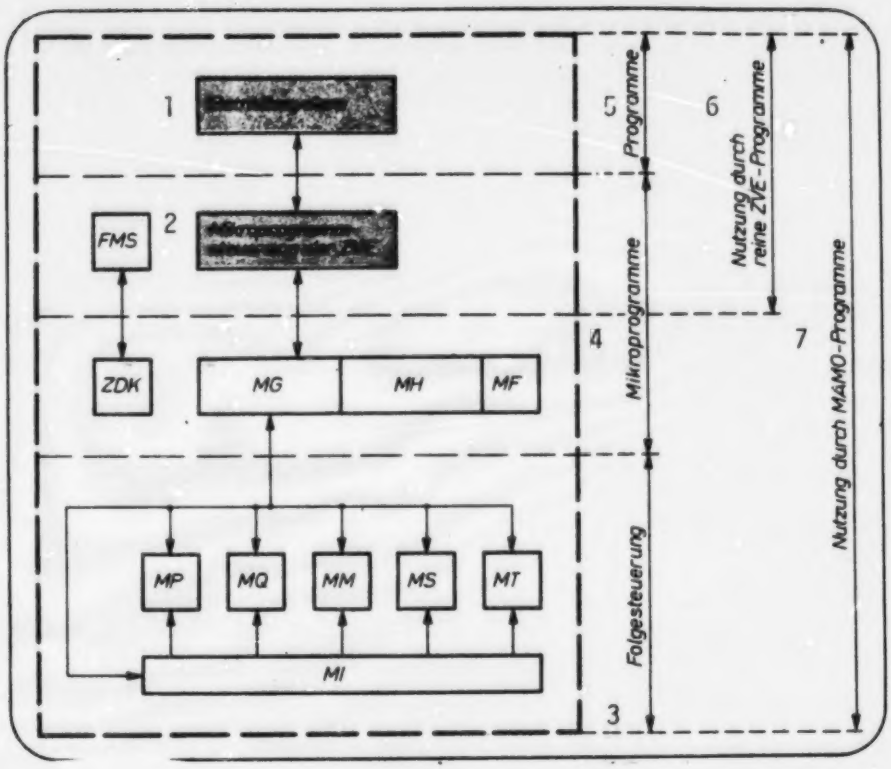


Figure 20. Control levels

1 operating system
2 microprogram control of the CPU
3 follow-up control
4 microprograms
5 programs
6 utilization by pure CPU programs
7 utilization by MAMO programs

In the above-mentioned pulse control modes, all MAMO-RAM storage locations can also be indicated and written on.

The above characteristics are the basis of the implemented testing means. The test is mainly done by:

Microtest 1 (MT1)

A CPU microprogram packet externally tests the CPU/MAMO interface and several basic functions, which are essentially used for communication between the CPU and the MAMO within the subsequent tests.

Microtest 2 (MT2)

MAMO test microprograms test the MAMO by functional units according to the principle of building-up tests.

Both test groups run under the control of the microtest monitor. The test programs work by building on the basis tests MT1 and MT2. Their main purpose is to check agreement of the MAMO function with the prescriptions of the MAMO operation principles and furthermore to supplement the testing stringency of the basic tests.

5. Preconditions for Operating the MAMO in the OS/ES

5.1 Logical Microprogram Memory LMPS, LTMPS

LMPS:

The MAMO has its own microprogram control unit.

Besides an ROM memory, which controls 32 microinstructions, all the remaining microprograms are located in a storage region (LMPS), which is situated at the end of the MS.

The MAMO uses its own RAM microprogram buffer with a capacity of 512 microinstructions (four bytes each). About the first 200 microinstructions form the core section, which is necessary to process all the algorithms. This microprogram core is loaded only once within the MAMO-IPL from the LMPS into the microprogram buffer. Then the MAMO is in the READY state.

If a defined subcode is transmitted to the MAMO, it will load the corresponding microprogram from the LMPS into the residual loadable part of the buffer. The loadable parts are called variable complexes and, with an LMPS version, they always have a constant length, i.e. 512 microinstructions minus the length of the core microprogram.

Up to eight algorithms are stored in a variable complex. A microprogram belonging to a subcode can be contained in several variable complexes, so as to save reloading time during certain instruction sequences in certain user programs. In order to communicate to the MAMO which subcodes are implemented by the microprograms contained in the variable complex, a subcode index with a length of two double words is chained to each variable complex. This subcode index is loaded by the MAMO in a small RAM memory. With further MAMO instruction steps, the MAMO checks whether the microprogram for the newly started MAMO field instruction is already contained in the loaded variable complex. If such is not the case, the MAMO loads the required variable complex automatically from the LMPS into its microprogram buffer.

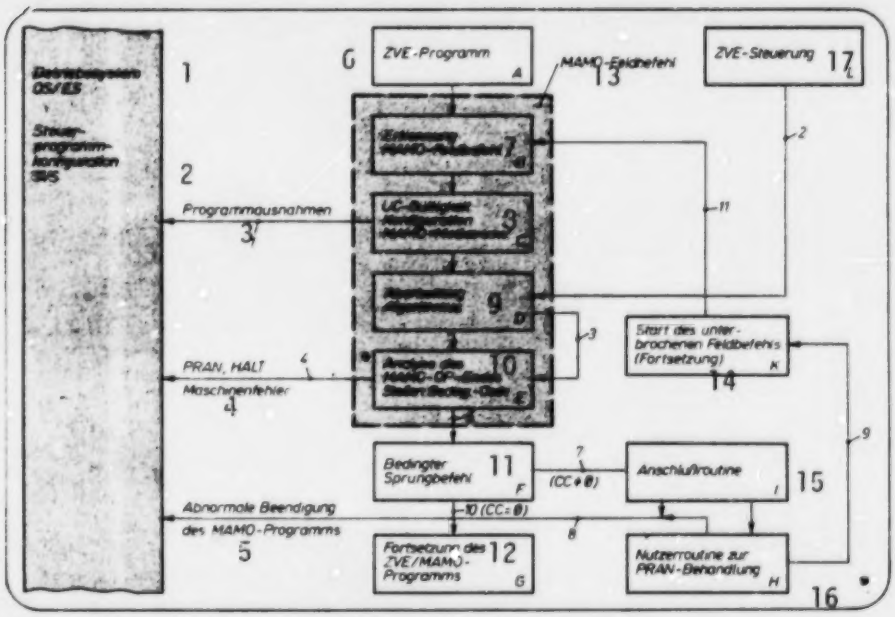


Figure 21. Most important activities when executing a MAMO field instruction

1 operating system OS/ES
2 control program configuration SVS
3 program exceptions
4 PRAN, halt machine errors
5 abnormal termination of the MAMO program
6 CPU programs
7 detection of the MAMO field instruction
8 UC validity, configuration, MAMO mode, etc.
9 processing algorithm
10 analysis of the MAMO-OP end position condition code
11 conditional transfer instruction
12 continuation of the CPU/MAMO program
13 MAMO field instruction
14 start of the interrupted field instruction (continuation)
15 connection routines
16 user routines for PRAN handling
17 CPU control

In order to control reliably the transfer processes of the LMPS file from an external data medium into the MS, all the data of the LMPS are added in double word fashion in a certain manner. The resulting sum is complemented and is entered in the LMPS at a certain address position. The CPU has microprograms which can be addressed partly automatically, and partly through the MAMO instruction LSM. These are capable of executing a test addition with the same algorithm. After a test addition, a 64 bit unit vector must be generated as the test sum through the LMPS content so that the entire LMPS is accepted as error free.

Figure 22. Representation of the condition code at the operation end of a MAMO instruction by the microprogram, block E

CC	Meaning
0	MAMO field instruction algorithm has been completely processed in the regular manner. The MAMO is ready to execute a new MAMO instruction
1	The algorithm was interrupted in its execution by an event The MAMO is busy and its algorithm can be continued at any time
2	The algorithm cannot be executed because of certain events The MAMO is not busy and is ready to execute a new MAMO instruction
3	Forbidden condition code

A slightly modified method is also used to test the steady microprogram loading processes between the LMPS and the MAMO microprogram buffer. If a test sum error occurs in the MAMO, the MAMO execution sequence is interrupted, and a message is sent to the CPU. The above-mentioned CPU test program then checks the LMPS in the MS. If it is okay, the MAMO is reported as being free of error. If the LMPS is defective, without the ECC equipment having responded, a machine error, generated by the microprogram, is reported.

LTMPS (Logical Test Microprogram Storage):

Also at the end of the HS, behind the LMPS file, is situated a region which is used for testing the MAMO.

This region contains:

loadable MAMO test microprograms
loadable CPU microprograms
test data, theoretical data
logout/login region
control tables for finding the individual files

The microtest philosophy of the MAMO provides that the entire test organization is executed by a microprogram CPU-MAMO test monitor. This test monitor is a component of the CPU microtest complex.

The tasks of the test monitor are the following:

Starting the individual test steps in the MAMO
Supplying the test steps with the special test and theoretical data
Theoretical/actual comparison after each test step and entry of the test results, in the case of an error, into the diagnostic buffer of the CPU.

5.2 MAMO-IPL

The MAMO-IPL program is a system-independent program for initializing the MAMO. The operating system support for the MAMO presupposes that, at the time the operating system is initialized, the MAMO is already functional. This means that it is capable of executing MAMO instructions in conjunction with an LMPS that is already located in the MS, and that, in conjunction with a likewise already loaded LTMPS, the MAMO microtest is ready to operate.

This operational readiness of the MAMO is produced by the MAMO-IPL program. It works system-independent and is executed before the start of operating system initialization. The self loading program MAMO-IPL takes care of loading the files LMPS and LTMPS from tape into the upper address region of the MS, and of initializing the MAMO.

Before the microprogram core-loading and the MAMO-READY switch-on can take place, the program performs, among other things, test-sum checks for the LMPS and LTMPS as well as a complete microtest in the CPU and the MAMO. After the MAMO-IPL program has terminated, the MAMO has the status "READY", "BLOCKED", and "NOT BUSY". The subsequent operating system IPL may be executed only with "IPL without erasing MS", so that the loaded files LMPS and LTMPS are not destroyed.

5.3 Control Instructions

The algorithms cited in Point 3.1 are only that part of the function which are exclusively oriented towards the problem solution of the user. So as to support the MAMO effectively in the operating system, the following six privileged control instructions have been created:

MUC: (MAMO USING CONTROL)

This instruction is used by the operating system to allow or to prohibit a problem program the use of the MAMO. The instruction also runs if a MAMO has not been configured in.

MST: (MAMO STATUS TEST)

This instruction uses the operating system to ascertain the usability of the MAMO.

LSM: (LOAD STATUS MAMO)

This instruction has a similarly far reaching significance for the MAMO as the diagnostic instruction has for the universal processor. It is used both for the operating system and also by the autonomous test programs. The instruction function is specified by a special parameter block. A few functions may be mentioned here:

"CORE LOADING" (IPL program)
LMPS/LTMPS sum check
login/logout
data transfer between LMPS/LTMPS region and the MS section used by the operating system
activation of arbitrary MAMO microinstructions, etc.

SMC: (SET MAMO COUNTER)

By means of this instruction, the operating system loads the MAMO counter, which, in a MAMO program, counts the number of MAMO instruction starts. The MAMO counter also continues to count when an interrupted MAMO instruction is continued.

SMT: (SET MAMO TIMER)

This instruction permits the operating system to preset the MAMO clock.

MMC: (MAMO MONITOR CALL)

By means of this instruction, the operating system causes the MAMO to report back to the operating system after it has completely processed the algorithm. This is done with a MONITOR CALL interrupt. In this way, a MAMO program of higher priority can be started.

In addition to these six privileged instructions, there are also three non-privileged control instructions:

STMC: (STORE MAMO COUNTER)

By means of this instruction, the user also can interrogate the number of MAMO instruction starts that have been executed in the program up to this time, so as to obtain information concerning the degree of influence of interrupts on MAMO performance.

STMT: (STORE MAMO TIMER)

Through this instruction, the problem program measures the pure MAMO time fraction in his program. For the operating system, this is used for billing purposes. Furthermore, the authorized problem program can ascertain whether the MAMO is busy.

RBB: (RESET BUSY BIT)

By means of this instruction, an authorized problem program can cancel the BUSY status, if it is impossible actually to continue the MAMO instruction after a continuable program exception.

6. Operating System Support

6.1 Support of the Programming of MAMO Problems

The MAMO is currently programmed in assembler language. By means of special assembler macros, work with the message block MIB is facilitated. The required

macro definitions are contained in the system library SYSS1.MACLIB.

The macro statements for the memory instructions are coded during programming like CPU instructions of the SS format, using the mnenomic instruction codes. The operand addresses point to the MIB and the PAB. By means of the macro MPB, the parameter block PAB is generated, and by means of the macro MIB, the message block MIB is generated. So that an already existing parameter block can continue to be used for subsequent MAMO field instructions, the macro MPB makes it possible to modify its content. The analogous procedure is made possible for the message block MIB by means of the macro MIB.

So that the MAMO can also be used in programs which are written in the higher programming languages FORTRAN, COBOL or PL/1, the respective connection macros must be used, so that the MAMO assembler routines can be integrated into the particular program unit.

6.2 Functions in the Control Program

The support of the MAMO in the EC-1055/EC-1055M configuration is effected generatably in the control program configuration SVS of the OS/ES. The control program configuration SVS permits adequately reliable protection against intentional or unintentional damage of the control files LMPS and LTMPS by problem programs. These control files are of life and death importance for the MAMO process in the system and they are situated at the end region of the MS. This property is achieved in virtue of the fact that the page frame table generated in the system initialization process does not contain the pages of the control data region at the end of the MS.

As a result of concealed machine errors, these protective measures may nevertheless become ineffective. Consequently, with dynamical microprogram loading processes, the sum tests are always performed with every transmission process, and thus such a false influence is detected.

On the part of the operating system, the MAMO field instructions are set equivalent to CPU instructions as regards their applicability. The control program assigns the MAMO to jobs running in the system according to similar criteria as are generally applicable for job selection. If the MAMO is not busy, and if a field instruction is called, it is assigned to the active job. This assignment takes place at least for the duration of one MAMO field instruction, since the MAMO is left behind in a not busy state only after completion of the instruction with CC = Ø, 2. As regards CC = 1, what has been said under Point 4.2 is applicable.

Multiprogram operation of MAMO jobs

The multiprogram operation of the MAMO is implemented with a specially created auxiliary means, the BLOCKED mode.

So that MAMO programs can be taken into account in accord with their priority, it is first of all important to inform the operating system of their appearance within the system, so that the new MAMO job can be placed in the queue in accord with its priority.

Since MAMO jobs do not differ externally from pure CPU jobs, a means must be found which allows MAMO utilization only to jobs authorized by the operating system. The BLOCKED mode represents such a means.

Its function is the following:

After the EC 2655 or the EC 2655M is switched on, the MAMO BLOCKED mode is switched on. Every attempt by a program to address the MAMO with a non-privileged MAMO instruction leads to an operation exception.

If the MAMO operating system support has been generated, the operation code of the instruction initiating the problem exception is analyzed. If the operation code is "E1" and the MAMO is in the READY status (see MAMO-IPL), the BLOCKED mode is switched off by means of the MAMO control instruction MUC. If the MAMO is in the NOT BUSY status, the corresponding job is immediately restarted. The current PSW now has free access to the MAMO during the running time of the program. If this job is interrupted, the MAMO can immediately again be placed into the BLOCKED mode through the control program by means of MUC.

Every MAMO program first begins with an operation exception during its first attempt to use the MAMO. In this way, the MAMO program is recognized as such by the control program.

So that a MAMO program which occupies the MAMO can be caused to give up control in favor of a MAMO program of higher priority, after the first program has completed the current MAMO field instruction, a MAMO-RUF trigger is switched on by the control program by means of the MAMO control instruction MMC. If a MAMO field instruction completes operation without leaving behind the MAMO in the BUSY state, and if the MAMO-RUF trigger is switched on, a MAMO call interrupt is initiated, which leads to immediate activation of the MAMO program with priority.

8348
CSO: 2302/4

TECHNICAL DEVELOPMENT POLICY, FUND ALLOCATIONS EXPLAINED

Budapest NEPSZABADSAG in Hungarian 7 Jul 82 p 10

[Interview with National Technological Development Commission deputy chairman Istvan Muller by Katalin Bossanyi, date and place not specified; "On Central Technical Development"]

[Text] For a long time, we have been devoting 3 percent of our annual national income to research and development (R & D) purposes. However, it seems this yearly investment is not in agreement with actual or potential results. Since the pace of economic growth has slowed, understandably less money is turned towards technical development. At the same time, changes in international commodity exchange rates necessitate more rapid modernization of technology and the productive structure. In this situation, we can predict for many future years how well we will be able to concentrate our financial and mental resources and what central orientation we will provide to enterprises in choosing their newer technological development directions. This task and responsibility falls mainly to the National Technological Development Commission [NTDC]. We spoke with deputy chairman Istvan Muller concerning the management functions of the NTDC, incentives for technical development, and possibilities for further extension.

Support for the Main Directions

[Question] A predetermined part of the technical development fund of industrial enterprises is centralized, and it is divided by the NTDC and industrial ministries. How do you administer this substantial development sum?

[Answer] In this plan period, the NTDC is working with a 9 million forint technical development fund. We support certain state-of-the-art technological developments or licensing procedures having them pay back only part of these funds or by offering the industries interest-free loans. In our experience, this increases the enterprises' incentive to accelerate technical development and to select the most economical solutions. This also increases the NTDC's risk--thus giving it the role of partner in the enterprise--because if we finance an unsuccessful development, then as a result our own support possibilities are decreased. Ten percent of the over 9 million forints represents a required reserve, which is maintained by the National Science Policy Committee for unexpected, urgent needs, such as the most pressing areas in the "technological

gap" between highly industrialized countries and moderately developed ones. The subsidized areas can be divided into three main categories. In the first belong the 14 medium-term research-development projects: in the Sixth Five-Year Plan, we will provide them with 3.5 million forints. The ministry programs will receive 2.8 million forints, and the remaining 20 percent is to be managed at our own discretion.

[Question] Are these internal ratios proper? It seems that what will be financed has been predetermined for many coming years.

[Answer] Without a doubt, this medium-range program seems excessive. But it is also true that the program is not only beneficial for one or two areas of enterprise or branches of industry, but for maintenance and strengthening of the competitive edge of the entire national economy as well. For example, I will mention energy conservation, machine production technology, support industries, microelectronics, original pharmaceutical research, pesticide programs, modernization of grain output and increasing protein production as targets of the program. It would be very difficult to select priorities or to rank them. However, I still feel that no matter how painful it may be for certain areas, further reductions in research-development programs are necessary. We must focus more on the few areas in which we already have the necessities for development, in which investment is worthwhile even in these capital-deficient times, and which serve long-range industrial policies and daily market interests equally well.

Inspection of the System

[Question] What business pursuits do you support? That is, in enterprise development programs, how is technical development supervised to benefit national economic interests?

[Answer] We select among the business technical development recommendations and requests on a competitive basis. In addition, we also initiate domestic use of research and development of new procedures. We strive to finance only those endeavors which represent technological advances and are advantageous to more than one enterprise. This is still valid if only a few enterprises receive the support. Central technical development, support or loans are comprehensive, trying to take in entire segments of technology. However, we can often support the purchase of only the most important components of the technological chain, sometimes because these are the most difficult for the enterprises to obtain, or because in this way we encourage them towards large-scale technological thought. This process is full of conflict, however. Occasionally, due to interim economic changes, funds become inadequate for the purchase of additional machinery, and thus "development islands" are formed. Yet an even greater worry is that joint ventures among enterprises are still chancy, although without them, a well-reasoned technical development policy is inconceivable.

[Question] Many regard the central technical development loans as "easy" money, since they come not from the strained development base, but from tax-exempt technical development funds. How are conditions for NTDC loans being tightened?

[Answer] I feel that technical development funds should be the most solid money, since our future is in question. All over the world, developmental breakthroughs serve as strategic steps, and the money used to support them is most often subsidized, for short-range market or economic reasons. However, this does not mean that the NTDC does not screen strictly the goals it chooses to support. In the past 2 years, some enterprises have been required to contribute to the financing of their technical development concepts; in our experience, this increases the collective interest. A business order is a requirement for central support to research institutes or university departments. Yet we do not want to perform a traditional bank role, either in drawing up the stipulations for loans or awarding them.

[Question] Then further restrictions are not necessary?

[Answer] Yes they are. Nonetheless, I will reverse the question: why should we further restrict financial conditions for technical development, when forced economic measures are already inhibiting technical advancement? Industrialized countries generally also offer state support, for example through tax benefits, to technical development projects which renew the productive structure or help catch up with technology. Here, however, the cost burden of some truly modern, technical-technological changes can so affect an otherwise technologically marketable product that a marketable price is no longer insured. Of course, slow and disorganized implementation also plays a part. Yet the limits of our methods stand out in how slowly technical development is taking place. Some enterprises "research" for many years just so they will not have to add a key machines, so necessary for production, to their fixed assets and thus burden their developmental base further. I myself have worked as both an enterprise and a ministerial director. Even with this experience, I can only say that on an every day basis, technical development and investment are not--indeed cannot be--separated as much as financial regulations require. More flexibility is necessary here, as well as more trust in the enterprise.

However, I do agree that more effective central orientation which better coordinates national economic and inter-industrial goals should be given a larger part, next to stricter selection and concentration of financial and mental resources. Thus, for example, the NTDC seeks to divide and decrease the risks for each enterprise in technical development projects which serve more than short-range enterprise interests.

Why Is Separation Necessary?

[Question] It is apparent that for realization of longer-range national economic goals, coordination of enterprise-industrial directions is necessary; for this, central bases provide the financial impetus. But why must development and technical development be considered separately at enterprises?

[Answer] Development and R & D are two different activities. I know that in principle, no enterprise is its own enemy; even if an enterprise creates no separate base for development, technical development will not be neglected. Yet in practice, for a variety of reasons, a separate development base is necessary as a kind of safety valve. The presence of technical needs also serves as a jolt which necessitates handling a development base. Original, significant ideas can rarely be pre-programmed. World market conditions change too quickly

for innovation to beat them, but we must work systematically at building a foundation for a long-range structure. Today, new results or development goals require the cooperative development of many enterprises or even branches of industry, which simple daily market automatism will not bring about. Thus the various special interests must be influenced through state coordination and support.

I am convinced that if, in the period of rapid growth, we had not created an enterprise interest in long-range industrial policy, then with today's more measured growth, it would be a waste not to utilize the slightly more independent, more market-oriented development bases.

All this does not imply that I find the present system of creating a technical development base immovable. Quite the contrary, it is my experience that we have not yet been able to coordinate the need for product development and the development keys. One relief is the modification instituted in 1979 that allows enterprises certain degrees of freedom in establishing the development base for each product, in order to determine how much of this base the market price will support. But it was precisely the implementation of the competitive price system that pointed out newer inequalities, which msut be examined.

[Question] The resounding theme of our discussion is that in technical development decisions, daily economic concerns and long-range industrial policy interests are at odds. Is this necessary?

[Answer] I think it is necessary that this clash is more apparent today than it was in past years. The same is happening all over the world. However, it is not necessary that we should set these processes against each other, considering the burdens on the national economy, the lack of balance, and the general recession. We are not dodging the issue, but rather we are forced to make crucial decisions even when we know that they do not coincide with our longer-range technical development conceptions. It is worthwhile to consider, on the other hand, why the average age of our products is still so high--statistically 5-7 years; this problem is becoming urgent. I think that lack of money for new investment is only one cause. An equally detrimental factor is a lack of an adequately coordinated, progressive industrial policy, due to institutional and industrial development direction causes. In my opinion, faster and more concentrated rebuilding of the productive system can be realized in the structural movements of the national economy, based and built on them. The open 5-year and 1-year plans, which are sensitive to world market influences, can only provide the economic framework for this process.

Industrial Policy Connections

[Question] How are industrial and technical development policy related?

[Answer] Some propose a superior-subordinate relationship between industrial policy and technical development efforts; but these processes can develop only through coordination and mutual reinforcement. Without pushing my own interests, I can state that the NTDC can play a larger role in the future; we do not concern ourselves with just one area of development, but ahve the means for exploring and coordinating interbranch connections and common technical development points.

Despite the present difficult economic circumstances, technical development could accelerate if we would take better advantage of the possibilities of capital movement among the various economic organizations. The use of technical development funds rests on precisely this point: we do not request more money from the budget, but redistribute one-third of enterprise development resources in those areas which will be more profitable to the national economy. The great responsibility of today's technical development is to transmit the necessary longer-range development impulses to the enterprises in time.

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END

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East Europe Report

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EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 753

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ERRATUM: In JPRS 81500 10 August 1982 No 751 of this series in article CSSR-USSR COOPERATION IN AGRICULTURAL SCIENCE AND TECHNOLOGY, p 10 para 1 lines 2-3 sentence beginning "In the..." should read "In the meantime CSSR offered the Soviet institute their method of "fertilizing with liquid pig manure."

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CURRENT SCIENTIFIC DEVELOPMENTS OUTLINED

Plasma Physics, Laser Micro-Fusion

Warsaw PRZEGLAD TECHNICZNY in Polish No 1, 13 Jun 82

[Interview with Docent (doctor of engineering) Slawomir Denus, director of the Sylvestor Kalinski Institute of Plasma and Laser Microfusion Physics in Warsaw, by Mieczyslaw Lomuda; date and place not specified]

[Question] Professor Basov in the USSR, Dawson in the United States and Professor Kalinski in Poland. Two scientific superpowers and a medium size country. Is not Poland's interest in thermonuclear reactors an example of megalomania?

[Answer] Of course, the dominance of research potential by the big powers is unquestioned. None the less, the field of plasma physics research is so broad that even the big powers cannot resolve all the problems. After all, such research was initiated by England, France and the FRG and later Japan. Poland became involved in lasermicrofusion in 1968, the sixth country in the world to do so.

[Question] Fusion achieved with the aid of lasers is but one of the ways to obtain a common goal--a controlled thermonuclear reaction. Why just lasers?

[Answer] In reality a large number of scholars in the world are concerned with generating and investigating plasmas in magnetic traps. These are closed traps of the TOKAMAK type as well as open traps, linear. These various paths lead to a common goal--the generation of thermonuclear energy, the energy that is released when individual nuclei of deuterium and tritium are combined into a nucleus of helium with the simultaneous emission of a neutron. Unfortunately, this is not an avalanche process; it is very difficult to achieve a self-sustaining effect. In TOKAMAKS--generally speaking, in all magnetic systems--the plasma must be generated and maintained for about one second and even tens of seconds in reactor systems. This is very difficult because the plasma subsists for a relatively short period with a tendency toward instability. To date, these instabilities have not been overcome successfully. By eliminating one and increasing plasma parameters, we generate others for which, unfortunately, there is no unequivocal formula. This is actually why other competing methods have appeared, the so-called inertial maintenance methods.

They boil down to this: a small ball of material (0.1 to 1 mm in diameter) from material which will fuse thermonuclearly in a sudden, collision-type way, is heated from the outside in a sperical, symmetrical system. The intense surface heating and vaporization of part of the material cause the rest of the material to accelerate rapidly toward the center and to compress and heat rapidly in the final phase. This is sufficient to initiate a thermonuclear reaction. These methods are interesting in that they do not require the construction of large and very costly installations to generate a magnetic field. In general, magnetic fields do not appear in them. However, the need to supply energy quickly causes problems. Time periods on the order of several billionths of a second come into play here. But the plasma life time is so short that the most formidable plasma instabilities do not develop. Somehow we outsmart the plasma, disallowing the generation of instabilities. Micro-balls can be heated not only by laser beams but also by electron and ion beams. In Poland the technology of building lasers was mastered at the end of the 1960's at the WAT [Military Technical Academy]. This determined the method selected. Today we use a four-beam laser, an instrument that was built during 1975-1978. With it we illuminate a ball symetrically from all four sides; this is the minimum number of beams which enables a spherical microfusion experiment to be realized. To achieve laser compression, about 10^{14} W/cm^2 of power are essential. The energy is on the order of 100 J and is sufficient to investigate the effectiveness of laser radiation adsorbtion as well as the heating and compression of the microsphere.

[Question] In what way do you believe the thermonuclear reaction really occurred?

[Answer] The emission of neutrons is the universal method used to ascertain if a thermonuclear reaction is occurring. During the reaction of a deuterium nucleus with another deuterium nucleus as well as during the reaction time of a deuterium nucleus with a tritium nucleus, that is in the two basic methods of realizing a thermonuclear fusion reaction, a neutron is emitted. The energy of a neutron is 2.45 Mev for a deuterium-deuterium reaction and 14 Mev for a deuterium-tritium reaction. Thus it carries the information that a thermonuclear reaction is occuring in a plasma. The number of neutrons is an indication of the intensity of the reaction. Fortunately, neutrons are very penetrating and can be easily recorded.

[Question] Speaking bombastically, when did the first thermonuclear reaction occur on Polish soil?

[Answer] The first such reaction was achieved in 1973, a short time after we initiated our activity. This was achieved through the great efforts of the entire team and the direct participation of Professor Kalinski. We achieved the effect with the aid of a single-beam laster which was used to irradiate deuterium exchanged polyethylene targets and lithium deuteride. These targets were prepared at the institute.

[Question] What happened after that, in the last 10 years?

[Answer] We started with a diagnostic base that was quite poor. We had equipment which enabled us to record the effects of a fusion reaction but not all the phenomena occurring in a plasma. Nonetheless, the successes were significant. In 1974 the team was awarded the Class I State Award. In the years that followed, above all we built increasingly powerful lasers, developed new diagnostic equipment and conducted research in the physics of plasmas, preparing a scientific cadre for the institute's needs. A two-beam laser was built and then a neodynium four-beam laser. In 1978 we decided that the technical base in the area of neodynium laser is the limit of the institute's and Poland's capabilities, and thus we would not build a larger-power installation. In the final analysis, these are very costly projects. However, we began to construct carbon dioxide (CO_2) lasers which are much cheaper.

We placed great emphasis on building and improving diagnostic equipment. Right now the institute's diagnostic potential is its greatest potential. These include: a large fan, auxiliary lasers, interfererometer systems, refined methods for measuring temperature using X-rays, methods for detailed investigations of plasma dispersion after compression, ultrafast cameras with image convertors and spectrometers with time expansion. This developed equipment permits us to conduct interesting research the results of which have been presented at many international conferences.

[Question] You established cooperation with the USSR....

[Answer] Cooperation began in 1972 at the USSR's initiative, specifically Nobel Laureate Orof Nikolay Genodevich Basov. The goals of the cooperation were defined precisely in 1974 when a 5-year cooperation plan was prepared. This plan was incorporated into the plan of cooperation between the USSR Academy of Sciences and the PAN [Polish Academy of Sciences]. In the framework of this plan, joint research has been conducted which contributed to our present award.

[Question] What was the award granted for specifically?

[Answer] For work ececuted jointly with the P.N. Lebedev Institute in Moscow. Our institute developed a set of apparatus for ion diagnosis consisting of a Thompson-type ion mass and energy analyzer, an electrostatic ion analyzer, a set of various types of ion collectors and nitrogen lasers to probe thick plasma layers. The apparatus was designated for common measurements in a 10-beam Kalmar-type laser system. With the aid of this equipment, very basic and conclusive measurements of many new elements in the investigation of plasma compression were made.

[Question] Now much did this research contribute to the knowledge of the processes occurring in a plasma?

[Answer] the joint research was the foundation for designing larger research installations. The system in which the research was conducted has an energy of several hundred Joules in the impulse. However, the research results are conslusive for higher-energy experiments. Higher energy experiments are

contemplated only by three countries: the USSR, the United States and Japan. It is not known if Japan will decide for extreme energy and perform what we call the breakeven experiment.

[Question] Are you considering further cooperation with the USSR?

[Answer] A system having a greater impulse energy has been built in the Soviet Union, and subsequent versions are in preparation for even larger experiments. The Soviets intend to involve us in research on a larger scale because, among other things, we have much experience and the appropriate potential to conduct diagnostic research of plasma.

[Question] Are other socialist countires also participating in this work?

[Answer] Microfusion is being realized only in the USSR. But TOKAMAK type magnetic traps are being realized by the USSR with the limited cooperation of Hungary, Czechoslovakia and Bulgaria. However, these are non-laser methods, and these countries have not acquired a very extensive segment of the diagnostic methods.

[Question] On your opinion, which of these methods auger the greatest hope?

[Answer] I believe that today the experts of the world have no one answer to this question. The very fact that all the laboratories in the world are aiming toward a common goal using various methods is proof that at this time none of them is acknowledged as the sole method presaging success. In countries which cannot afford it, the decision makers undertake risks backing this or that method. The countries which can afford it--the United States and the USSR--support all methods.

[Question] When will we build the first thermonuclear reactor--we, civilization, of course?

[Answer] Basic unknowns exist which make that very difficult to forecast. The problem is that one cannot theoretically forecast all the phenomena that are occurring in a plasma vis-a-vis when increasing energy, the size of the equipment or increasing the power supplied to a core. That is why it is necessary to conduct experiments on an increasingly larger scale. Thus, the step-by-step strategy has been accepted. There is certainty in the state of knowledge and state of technology which permits prognoses one step ahead. Experiments at a higher energy level must be conducted next. But even with the step method, not all theoretical forecasts prove true. It happens that theory presents a pessimistic picture, but because of the nonlinear character of the phenomena with which we have to deal with, the experimental results are better. It turns out that nature does not want to realize all the mischief predicted by theory. But only after an experiment is conducted on a larger scale do certain plasma characteristics appear which in general were not predicted by theory.

However, the more far-reaching prognoses are optimistic. Optimistic in the sense that thermonuclear fusion will be realized. It is expected that in the 1980's it will be demonstrated that the energy released will be greater than the energy supplied in systems such as the TOKAMAK in the USSR and United States or in Shiva-type laster systems or perhaps even in systems using ion beams.

[Question] Will a thermo-nuclear reactor be built before the end of the century?

[Answer] The reactor which will be built and connected into the network will appear only after the need for it has been demonstrated vis-a-vis the world energy crisis, and not earlier. I will explain this. The use of fusion systems, which are not yet contributing energy to the network but can produce nuclear fuel, is a more appropriate technology than thermo-nuclear reactor systems. Analyses conducted by some teams show that nuclear power plants, which make a significant contribution to energy production in the 1990's, have a natural fuel supply for only about 30 years. Even spreading out the construction of such power plants are planned so that the nuclear fuel would suffice for a longer period. Then the uranium crisis will appear. Beyond that, the only possibility of producing nuclear fuel offered by nature is the use of fast neutrons. Such fast neutrons are produced on a large scale precisely by thermonuclear systems. However, I would like to emphasize strongly that they will not be systems producing energy for the network. They can have a coefficient of efficiency less than one, even a lot less. Theoretical calculations indicate that a thermonuclear reaction in TOKAMAK and laser systems as well as in plasma-focus systems produce just enough neutrons so that these neutrons will be captured by natural uranium-238, the dominant (over 90 percent) isotope of uranium ore, and which today represents a waste product of fuel produced for nuclear power plants. This uranium can be converted into plutonium. A single laser microfusion system or any other kind of system generating neutrons at a level of 10^{16} neutrons per impulse will be able to produce fuel for five to six nuclear power plants.

[Question] Much hope is being placed in breeder reactors.

[Answer] Breeder reactors fall somewhat short of our hopes. Their characteristics are such that a single breeder reactor can produce fuel for itself and about 0.6 for the next breeder reactor. On the other hand, one quasi thermo-nuclear system can produce fuel for 5 and, according to some, even for 12 nuclear reactors. In the latter case, we could delay the uranium crisis 100 to 150 years.

[Question] We bought time to develop a thermo-nuclear power plant.

[Answer] If we want to build a nuclear power plant knowing that these electric power plants will have fuel for only about 30 years, then we must start developing fusion systems today. We must think about initiating the first such system in a couple of years. Thus, not much time remains.

It may finally turn out that in the near future we will not want to reach the thermo-nuclear reactor level as an independent source of energy, that we will be satisifed with having a cheap auxiliary system to produce fuel for nuclear reactors.

I believe that under these circumstances the technology of laser microfusion is very suitable. Here plasma is generated in small volume and, in assocation with this, there is a possibility of very intensive U^{239} irradiation.

One can liken it to a source of neutrons. A nuclear fuel production system can be relatively small. A 2 to 3 m diameter chamber is sufficient. Plasma-focus type systems are also very efficient and relatively cheap sources of fusion neutrons. They also will be used in hybrid systems to produce nuclear fuel. Our institute, in collaboration with the Institute of Nuclear Research in Swierk, is conducting plasma research in this type systems, which represent a scientific research direction independent of laser microfusion.

[Question] Thus, it is not megalomania, but an integral concrete economic strategy.

[Answer] I believe that at Poland's present stage the most important thing is to maintain a proper potential of knowledge and technology. It takes 10 to 12 years to train a team capable of doing this type work. It is important that when the time comes that we have the capability of building hybrid systems (production of fuel by the laser microfusion method plus a nuclear reactor burning this fuel) then we should take part in it. Of course, above all, those who are knowledgeable in this area will have access to this technology.

[Question] Fortune favors those who are prepared.

[Answer] Today that preparation is our greatest capital.

For the first time the PAN and the USSR Academy of Sciences won an award for exceptional joint scientific achievements resulting from the cooperation between both academies. These awards are given once every 3 years, on the anniversary of the signing of the agreement on scientific cooperation between the PAN and the USSR Academy of Sciences.

Among other things, this year's award was for the development of a method to diagnose and investigate thermonuclear targets heated and compressed with the aid of a laser. Included in the team winning the award are: Docent Dr Slavomir Denus, Dr Jerzy Wolowski, Magister Jozef Farny and Magister Eugeniusz Woryna of the Institute of Plasma and Laser Microfusion Physics and their colleagues from the USSR Academy of Sciences Institute of Physics: Dr Gleb Sklizkov, Dr Andriej Shiknov, Jurij Zakharenkov, candidate of mathematical-physical sciences, and Engineer Aleksiej Jerokhin.

Radioactive Isotope Production

Warsaw RZECZPOSPOLITA in Polish 11 May 82 p 5

[Article: "Isotopes for Industry"]

[Text] The Center for the Production and Distribution of Isotopes of the Institute of Nuclear Research in Dwierk is the sole producer of radioactive isotopes in Poland. Radioactive substances used by industry and others are obtained by irradiating so-called target materials in Ewa reactors and partly in the Maria reactor.

Scurces of iridium-192 (its production completely satisfies domestic demand, and 30-40 percent is designated for export) and yttrium-169 are used in industrial radiography and flaw detection. Sources of cobalt-60, cesium-137, europium-152 and 154, and strontium 90 are employed in devices that utilize scattering and ionizing radiation phenomena, in isotope relays, level gauges, thickness gauges and in conveyor scales.

A large portion of the production and sources of isotopic smoke detectors. The technology of their production is based on depositing a radioactive glaze containing plutonium-239 on an aluminum base.

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COLLEGE COMPUTER NETWORK SYSTEM DESCRIBED

Prague PTT REVUE in Czech No 3, 82 pp 73-75

[Article by Engr Jiri Navratil, Advanced School Regional Computer Center: "Terminal Network of Advanced Schools Regional Computer Center"]

[Text] The use of computers has a tradition of many years of standing in organizations under the jurisdiction of the Ministry of Education. However, for many years the level of their technical facilities was average or rather below average. A sudden qualitative change was brought about only when the ICL 4-72 computer was installed in 1976.

The computer system, which is available to users from the department of education at the OVC VS [Advanced Schools Regional Computer Center], consists of a ICL 4-72 central computer with one M bytes of operational memory and 600 M bits of disk memory, four ICL 2904 computers (each with 64 K words of operational memory and summary disk capacity of 290 M bits) and additional (peripheral) equipment. It represents not only the most efficient computer system in the department, but is also one of the largest installations in all of of the CSSR. The computer system forms a comprehensive terminal network with more than 50 terminals, in which ICL 2904 computers are connected as satellite computation means (efficient intelligent terminals) of the central system. Each computer in the network has its own network of interactive terminals. The central computer has been in operation for several years in three shifts, and the terminal network is available to the users more than 12 hours daily.

The installation of the system has not only brought about a sudden qualitative change in the work of programmers, but the system makes it possible to process extensive program sets which so far the users in the department have not been able to process, and it provides new opportunities, which can be utilized especially in the area of science and pedagogics.

The conditions under the jurisdiction of the Ministry of Education are rather different from those under the other ministries. While in most computer systems operating in industry or in the central administration, the work concentrates mostly on the ASR [automated management system], the computer system under the Ministry of Education must take care first of all of the areas of pedagogics, scientific research, and also of the ASR area. Each of these areas has its specific characteristics, which have to be taken into

consideration in forming a balanced relationship between the needs and requirements of the users and the capabilities of the system.

For the time being, the most significant users who are making an intensive use of the computer system of the OVC VS are workers from nine advanced schools in the entire CSSR. On the average they use 83 percent of the capacity of the machinery in terms of time, generally in dealing with the tasks of the state plan of basic research

The problems which are handled here are very broad and cover practically all areas of our lives, ranging from agricultural research studies (VSZ [Agricultural College] in Prague) through economic issues (VSE [College of Economics] in Prague), technical areas (CVUT [Czech Institute of Technology] in Prague), VUT [Institute of Technology] in Brno, VSDS [College of Transportation Services (or Systems?] in Zilina), chemistry (VSCHT [College of Chemical Technology] in Prague and Pardubice), all the way to nuclear physics (UK [Charles University] in Prague). During 1981, for example, the computer system dealt with more than 200 research tasks of the state plan, many of them in cooperation with foreign partners, especially Soviet partners (SUMV [Soviet Nuclear Research Institute] in Dubna, USSR Academy of Sciences, TU [Technical University] in Dresden, and so on).

The remaining two areas are not so clearly defined. In the pedagogical area, the bulk of basic courses of student programming involves the use of computers of individual schools, while the OVD VS deals only with specialized services, especially in those fields which are oriented to computer engineering and informatics. The ASR area is still in its beginning in organizations under the jurisdiction of the CSR Ministry of Education, but during the forthcoming years these tasks are also expected to show a major increase.

One of the basic problems of effective utilization of computers is their great imbalance between the speeds of their electronic and mechanical parts. Thus commercial computer installations operating without multiple access, which means without numerous terminals, actually have their computation capacity dependent to some extent on the passage capacity of the classic input and output peripheries. A tremendous amount of data is continuously passing through relatively slow peripheries of the system (scanners of paper media and the printers), which puts a heavy load not only on the system but also on the service personnel. Most of these problems disappear when a terminal network and a sufficiently large disk memory is used. Each user of the terminals has an area in the disk memory allocated to him. He keeps his data and programs there, and by giving a simple instruction he can start at any time to release even several programs, check the flow of their computations, intervene in the computation process or stop it, and then print the output sets only when everything is in order. These questions come up especially during fine tuning of new programs, when errors occur frequently either during compilations, or when logic errors are made during trial runs. Direct contact of the programmer with the computer not only results in savings of all the means of the system, but also makes his own work more effective. The time of preparing a new program is reduced several times when interactive contact is used as compared to the standard dosage method.

The advantages of the systems using time participation in their operations are clearly apparent to everybody today, but of course this processing method also has its pitfalls. The computer system is being given to a certain extent for free use by those users whose requirements are made quite incidentally, and the size of their assignments also vary. Consequently the users may sometimes create a critical situation, when the system becomes heavily loaded, and the service personnel must deal with it immediately. This naturally increases demands in terms of quality of the personnel servicing such a computer system, and to a certain extent it also changes all standard organizational diagrams. A few operational data will perhaps provide the best way of drawing a complete picture of the entire problem.

The central computer of the computer system of the OVC VS processes more than 1,800 assignments daily, and more than 95 percent of these start at the terminals. In addition to the fact that the terminals make it possible to start running the assignments, each operational system which provides multiple access also offer a number of other opportunities to prepare its own data and programs for further processing. This function is also taken care of in the Multijob operational system. It means in practical terms that the user can form from the terminal new sets of data, check them, correct them, print them, cancel them, and so on, all this by merely giving the so-called terminal orders. These orders actually constitute the basic communication language between the user and the operational system. The user has 49 of them at his disposal at present. They are effective, as indicated for example by the fact that the users apply in the course of a day about 6,000 sets.

The existing data base of an ICL 4-72 computer contains about 15,000 sets (the existence of the data base is one of the conditions of the existence of a terminal network). The data base was being created gradually, in practice from the time when the computer was put in operation in April 1976. It contains both data as well as programs of the users. More than 7,000 sets with a total capacity of about 240 million symbols are maintained at present on the average for immediate use (on-line) by the users. Also, about 2,000 additional sets (90 M bytes) are constantly available. These constitute the libraries of the system and of the system's frequently used programs.

The remaining sets are kept on tapes and are integrated in the system according to a regular daily plan or at the owner's request.

The data base has naturally an entirely different structure as compared to the data base of some enterprise or departmental institute, where teams of programmers are developing programs for the processing of information coming from a certain area, and other teams of workers are collecting and preparing data for periodic processing.

The data base of the OVC VS kept developing depending on how the computer was used during 6 years of operation. Since the computer was used mostly to deal with scientific and technical tasks coming from a very broad area, and since the computer system serves more than 150 entirely different types (departments of advanced schools, institutes, and laboratories), which represents about 1,000 programmers, the volume of the actual data is

relatively small, while the number of the programs reaches the figure of several thousand. A tremendous number of changes is made continously because of the existence of the terminal network, and because of the high degree of parallel processing of the assignments. The users operate with several thousand sets daily. The speed of data replacements can be characterized for example by the number of inputs on individual disks, which vary around 90,000 per hour. Since 1976 the terminal operation has increased about 2.4 times, the average frequency of instructions issued from terminals in 1976 was 8.8 instructions per minute, in 1980 it was as many as 21.2 instructions per minute.

Most of the terminals in our network operate as interactive terminals. All of them are equivalent in relation to the system, and only their physical properties determine how efficient they are now and how popular they are.

The most popular and also the most efficient terminals are alphanumerical displays (ICL 7181). It is particularly appropriate to use these terminals in applications where a short time response is required, or where complex texts, tables, or forms are used. Data which are to be used as input for the computer are shown on the screen and at the same time are placed in the balancing memory. This makes it possible not only to maintain optical control, but also to correct the data before they are sent in the computer. In order to make the user's work easier, they are equipped with internal functions which provide for simple editing of the text (insertion, erasure of symbols in any position), and they also have other properties, such as the ability to use different types of print, intermittent light, the so-called protected fields which cannot be transcribed from the keyboard, and so on. Their equivalents are being tested at present experimentally. It was possible to create these equivalents by using a domestic processor SPU 800 and its peripheries.

The teletype (ASR 33) was for a long time the most widely used type of terminal. Each of the almost 20 HP [units[used in the network since 1976 has completed now more than 4,000 operational hours. It is true that this type of terminal was not too popular because it is noisy and slow, but of course its cost was low, and in addition it makes it possible to keep permanent records. This is a valuable feature, especially in those workplaces where it is not possible to get the prints quickly from printing plants (outside of the Prague area). These terminals will now be replaced by domestic SM 7202 terminals, which successfully passed experimental operations tests in 1981.

The most efficient terminals of the system are the four ICL 2904. Each one of them can operate by itself as an independent computer, in addition to being connected with a central computer. From the central viewpoint, these computers are to be used primarily for long distance data transmission, when the volume of the data exceed the capacity of local facilities. Data which are to be transmitted are concentrated first of all in local disk sets. The operators then sends them for processing to the central system. The results are obtained in a similar way from the central system. Each of the ICL 2904 terminals is equipped for this regime with several (4 to 8) simple screen terminals (DDE), which can be used to form local sets. Linear printing machines are used as output equipment. The ICL 2904 system is also equipped with several disk memories, which provide for an adequate memory capacity for the formed sets and for the basic data base for creating a terminal network at this level of the hierarchy.

The terminals are located in advanced schools and institutions of the CSR Ministry of Education. Advanced schools offices in Prague are covered most intensively. Among those located outside of Prague, the first one connected was the Advanced School of Mechanical and Electrotechnical Engineering in Plzen (1976), later on the VSDS in Zilina (1977), and the VUT in Brno (1978). At present, this applies also to the VSB [Mining College] in Ostrava (1980), and the VSCHT [College of Chemical Technology] in Paradubice (1982).

Many interconnected terminals are located on the premises of the advanced schools in Dejvice. They use the local telephone network as connecting lines. The other interconnected terminals located in Prague and other cities use the state telephone network. Most of these connecting lines terminate in EC 8002 modems operating at speeds of 110 or 300 Bd [bauds]. In the area of Dejvice connections are made automatically by dailing the four-digit number of the branch telephone exchange ending with decimal series, and in the case of other terminals (including those outside of Prague) by dialing a public network number ending in a decimal series.

ICL 7181 videoterminals or their equivalents (SPU-800) are usually conntected to leased fixed circuits. They operate at a speed of 1200 bytes per second and use 8006/S2 modems.

ICL 2904 computers are located only in offices in Prague at a distance of 0.2 to 10 kilometers from the center of the network. They are connected with the center by fixed-semi-duplex connecting lines of 2,400 b/s terminating in RAGAL-Milgo 2200/24 modems.

The overall structure of the terminal network is shown in the diagram. All terminal means and forms of connection (concentrators, multi-point connectors, and so on), which occur in the network, are shown here at least in a diagramatic form.

To maintain the optimum level of equipment, the OVC VS is striving to bring about purposeful technical development, which is being gradually carried out with the full understanding of the Ministry of Education and of the CVUT. During the 6 years of existence of the OVC VS, the entire configuration of the computer system has been expanded substantially. The system is being carefully adjusted, so that it can better satisfy the conditions under which it operates, its operational interchangeability has been increased; the work of users has been simplified and made more efficient, and the reliability of the system has been increased. Through active cooperation with domestic and foreign partners, the system has been augmented by adding a whole series of significant program units (compilators, libraries, and application programs), which have enriched the already relatively wide scale of opportunities for data processing in the OVC VS).

FIGURE APPENDIX

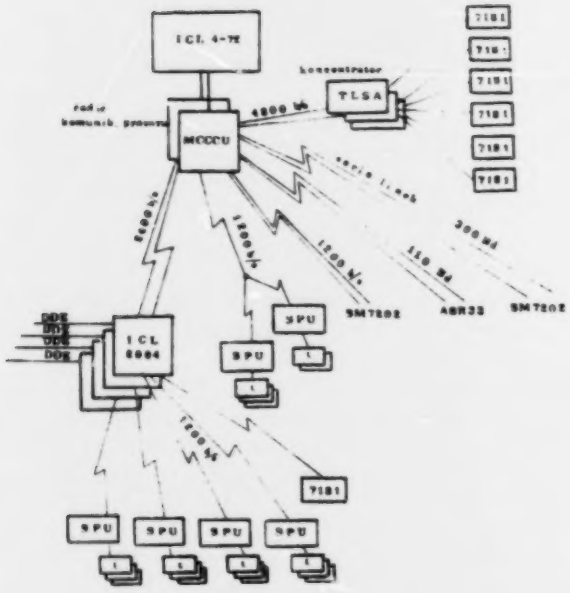

Diagram. Strucute of the terminal network of the OVC VS in Prague

Legend: a. Operational communications coordinator
b. Series of lines: 300 bauds
c. Concentrator

5668
CSO: 2402/65

DEVELOPMENTS IN ROBOTRONICS DESCRIBED

Bratislava PRACA in Slovak 25 May 82 pp 1, 4

[Article by Eng Julius Uhrin, Deputy Minister of General Engineering: "Development of Robotization in Czechoslovakia"]

[Text] The development of the national economy is imposing steadily increasing demands regarding the development of manufacturing processes, production machinery and equipment, and the mechanization and automation of production and of general engineering.

By introducing automation and robotics we aim to increase the social productivity of labor and the quality and efficiency of production processes and to humanize labor. The last decade has seen the advent of microelectronics, automation and robotics, especially in research, development and testing in both production and nonproduction processes and technologies.

Conception of Automation and Robotization

Automation of manufacturing processes in our plants should be pursued in comprehensive fashion. In addition to automating primary production, we should also automate transport, materials handling, product measurements, tool changing, monitoring and other activities.

Industrial robots and manipulators have an essential role in this process. They create the conditions for successful automation even in small-series and one-off production. They replace human labor in unhealthy or unsafe surroundings. They make it possible to increase the productivity and quality of work. They can function without stopping in three-shift or continuous operation. Robotization of industrial processes is one of the decisive measures planned for the future which will make it possible to introduce automation in machine-building and non-machine-building processes, using the capabilities of industrial robots and manipulators.

Industrial robots are flexibly programmable automatic devices with many degrees of freedom. They tend manufacturing machinery, handling materials during operations and sometimes between operations. They replace humans in the repetitive, monotonous activities of tending machinery.

Industrial robots have been most extensively introduced in machine building. During the Eighth Five-Year Plan they will also enter other sectors. The development of industrial robots is having a fundamental effect on the main areas of development of production machinery, where the trend is toward grouped use of machines in combination with industrial robots and manipulators.

We in Czechoslovakia are now in the initial stage of robotization. Automation of production processes with industrial robots is being pursued over the entire spectrum of research, development, production and use.

The concept for developing robotization is elaborated in State Special Program 07, whose main objective is to expand the automation of production processes by the introduction of industrial robots and manipulators. This requires that at least 4,000 units be produced during the Seventh Five-Year Plan and at least 13,000 by 1990. Their production will require expanded production of electrical, electronic, hydraulic, pneumatic and mechanical parts and assemblies.

The main tasks of the program are:

--by introducing industrial robots and manipulators, to free up at least 55,000 workers and users of this new equipment in 1985;

--to create the main conditions for expanding the range of production processes automated with industrial robots in subsequent five-year plans, achieving major technical, economic and export effects.

The development of robotization in Czechoslovakia will have the following main stages:

--development of a basic standard series of industrial robots and manipulators in the context of state assignments for the development of science and technology during the Sixth and Seventh Five-Year Plans;

--gradual introduction of serial production of robots and manipulators that have been developed, as well as other equipment for in-operation and between-operations handling, during the Seventh Five-Year Plan, so that they can be used to create fully automated manufacturing workplaces;

--development of a production base to produce this equipment;

--test installation of industrial robots and manipulators in selected machine-building and non-machine-building processes to form automated manufacturing workplaces and lines;

--development of adaptive industrial robots and standard-design manipulators, with additions to the standard series in connection with the CEMA robotization program during the Seventh Five-Year Plan;

--development of modular industrial robots, with expanded production of components and modules in cooperation within CEMA during the Eighth Five-Year Plan;

--automation of production processes, using industrial robots and manipulators in both machine-building and non-machine-building processes, by gradually introducing automated manufacturing workplaces, automated production systems, robot production lines and integrated production units during the 1980's and 1990's;

--basic and applied research on components for artificial integration [misprint for "artificial intelligence"] and new, promising structures for production process management supported by organizations within the Czechoslovak Academy of Sciences, the Slovak Academy of Sciences and advanced schools.

Preconditions and Problems of the Development of Robotization

Automation is a long-term process of structural transformation of the production base. It must not be approached as a one-effort problem. Technically and economically effective introduction of automation facilities requires that much effort be expended in research, planning and production activities. The decisive criteria for successful introduction of automation and robotization are:

--reliable production operation of automation equipment;

--economically effective production with the new equipment;

--social-societal factors.

Reliability must constantly receive top priority in the technical facilities of all levels involved in development of the new equipment (components base, production equipment), and in all pre-production and production stages of work (research, development, planning, engineering, production and operation of systems). According to our current understanding, the reliability of industrial robots and manipulators depends on the reliability of the production equipment. Most often it is the auxiliary and accessory equipment of workplaces which has the lowest reliability.

The functioning of industrial robots is determined by the reliability and quality of the parts and components used in their production, such as control systems, electric drive components, and hydraulic, pneumatic and other components. In the robot-equipped workplaces put into operation in 1980-81, the control systems are not yet superior to the mechnical and functional components of robots in terms of reliability. In addition to improving the technical quality of mechanized components, it will also be necessary for the electronics industry to make an intensive effort to raise the level of reliability and durability.

In our plants the reliability of automated workplaces is highly dependent on the approach taken to building and maintaining the workplace. Intense

cooperation of users in gradually putting automated workplaces into production is the first precondition for success. For example, excellent results have been achieved by AZNP [Automotive Works National Enterprise] in Mlada Boleslava in the production of aluminum castings by the pressure casting method, using an automated manufacturing workplace consisting of injection presses with an industrial robot. Another example is a machining station at Jihlovane Jihlava. One of the first applications of robots in non-machine-building production has been the hot pipe handling machine at Kavalier Hostomice.

Experience indicates that the greatest effect can be achieved with grouped introduction of industrial robots and manipulators as part of manufacturing complexes and automated lines, sections and shops. The introduction of individual industrial robots is not always effective and is economically costly.

More than 200 automated manufacturing workplaces with industrial robots and manipulators with various levels of function are operating in our industry. Experience shows that their effective introduction depends on suitable choice of manufacturing operations for robot operation and suitable grouping of production equipment into an automatic cycle. In many cases there arises the problem of adapting production machines to automated operation. A critical factor for successful introduction of industrial robots and manipulators is that engineers and management personnel make a positive effort to support all aspects of preparation for the introduction of new equipment, including training personnel sufficiently in advance. It is also necessary to make effective arrangements for all material and technical support of the introduction and operation of automated workplaces so as to achieve the maximum effect.

The first series of industrial robots and manipulators are already being produced. Their prices are high because serial production is just beginning and because the components used in production are costly.

It is also proving necessary to put in intense work on electric and hydraulic drives, electronic control systems and the like so as to solve the problems of achieving optimal technical and economic characteristics.

Carrying Out the Assignments

The manager of State Special Program No 07 is the Ministry of General Engineering, which is cooperating closely with the ministries of Technical and Investment Development, Metallurgy and Heavy Engineering, and the Electrical Engineering I-dustry in the development of robotization. The leading organization for scientific and technical development of industrial robots and manipulators is the Research Institute of the Metals Industry (VUKOV), which is also required to support the program and is coordinating the development of industrial robot production and introduction in Czechoslovakia. Serial production of industrial robots and manipulators has begun in the enterprises ZTS [Heavy Engineering Works] Detva, ZTS Kosice, BAZ [Bratislava Automotive Works] Bratislava, TOS [Machine Tool Plants] Trencin, Trojsmalt Medzev, ZPA [Machinery and Automation Plants] Presov, ZEZ Prague, BEZ [Bratislava

Electrical Engineering Plants] Bratislava, Vyhorlat Snina and Skoda Ostrov nad Ohri. Last year the enterprises produced almost 300 robots and manipulators, which are already in operation at automated manufacturing workplaces. This year the plan calls for production of approximately 650 industrial robots and manipulators and preparation for their introduction in users' facilities. Robot production during the Seventh Five-Year Plan is to use existing production capacities. New facilities will begin to have an effect on output by 1985 and during the Eighth Five-Year Plan.

We are gradually beginning the production of seven types of industrial robots and at least 20 types of manipulators. In addition, we will be further expanding the production of the balancer-type hand-operated manipulators. The types of industrial robots and manipulators in production are intended for tending machine tools and forming machines, for handling sheets of metal, glass or wood, and for arc and resistance welding. The development of robots for surface finishing is being completed. Development work is aimed at developing the next generation of so-called "adaptive" industrial robots and standard-design manipulators. Devices which have been developed thus far are designed for loads of 1 to 125 kg.

The organizations UTK [Central Technical Commission]-SAV [Slovak Academy of Sciences] and VST [Institute of Technology] Kosice have made an important contribution to the development of a standard series of industrial robots and manipulators; they have oriented most of their capacities toward basic research, particularly for next-generation industrial robots. Also an important contributor is VUVT [?Research Institute of Computer Technology], Zilina, which provided most of the microprocessor-based control systems.

Introducing industrial robots and manipulators into production requires extensive initiative on the part of industrial enterprises and design and research and development organizations. Programs for introduction of industrial robots and manipulators during 1983-1985 are being developed. Every plant, factory or shop can help in this work by identifying units suited to robotization. Expert analysis of the proposed workplaces is performed and design proposals produced by designated design entities. These are concentrated in VUKOV Presov and in planning organizatios such as Projekta, Kovoprojekta, Hutny projekt, INPRO, UTAR, PIZAK and other enterprise organizations for technical design, particularly in the CAZ [Czechoslovak Automotive Works] VHJ and AERO. These organizations also attend to the installation and breaking in of production units for the users.

The development of robotization is imposing new demands to increase the skills of workers, in which specialized schooling may also play a role. Accordingly we must train new specialists for all levels of activity. Specialized advanced-school training oriented towards robotics, robot technology, and industrial robots and manipulators is already being provided by CVUT [Czech Institute of Technology] in Prague, SVST [Slovak Institute of Technology] in Bratislava, VST Kosice and VUT Brno. The skills of engineers and technicians are being upgraded by specialized courses and seminars organized by selected specialized organizations, research institutes and schools in cooperation with groups of specialists in CSVTS [Czechoslovak Scientific and Technical

Society]. Training of specialists to operate, program, maintain and service industrial robots and manipulators has begun at intermediate specialized machine building and electrical engineering schools and technical schools. The basis for systematic work in this area is agreements between the coordinating organization and the individual departments in advanced schools. These forms of education will have to be considerably expanded in coming years as the need increases.

International Cooperation

Great attention is being devoted to robotization in the Soviet Union, East Germany, Bulgaria and other CEMA countries. International cooperation in research, development and production within CEMA is an effective means of accelerating robotization. Czechoslovakia is included in the multilateral scientific and technical cooperation of the CEMA countries aimed at developing industrial robots and manipulators, as well as control systems and production machinery and lines. We are a party to the agreement on specialization and cooperation in the production of industrial robots signed by the CEMA members.

In 1979 we began joint development of industrial robots with research organizations in the Soviet Union. The first three types of industrial robots, designated AM 5, MTL 10, and UM 160, were successfully developed in 1981. Cooperation has considerably accelerated development and decreased expenditures in the research stage. The jointly-developed types of industrial robots form the basis for export of robots to the Soviet Union during this five-year plan. The effectiveness of future development is being greatly promoted by the concept for the development of robot engineering in the CEMA countries which was approved by the 112th session of the CEMA executive committee. This unified technical concept is based on thoroughly modular design of industrial robots and manipulators. Preconditions include the standardization of modules, assemblies and components of robots, manipulators and auxiliary equipment, and specialization in their production.

Rapid, effective utilization of the newest achievements of science and technology in joint work is the basic precondition for the dynamic development of our advanced socialist society. Achieving the goals that have been set will require an active effort on the part of workers, collectives and especially the operational management of plants, VHJ's and ministries. We expect that the Heavy Machine Works [VTS] VHJ will play a decisive role by creating the conditions for producing welding robots and modular manipulators for machining lines and for building automated workplaces for surface forming. The TST [Engineering Machinery works] VHJ is making a critical contribution to the gradual integration of machine tools and robots into so-called "unattended production machines," which use chiefly special manipulators produced within the VHJ itself. A major task faces the Czech Automobile Plants VHJ, Strojsmalt and PRAGO-UNION, which will be the main users of this equipment and accordingly must develop their own engineering design capacities and prepare to modernize their products and processes. The introduction and mastering of the new equipment offers room for extensive worker initiative.

An example is the enterprises and organizations of the East Slovak Kraj, which in 1980 undertook a joint socialist commitment aimed at speeding up automation and robotization in Czechoslovak industry.

8480
CSO: 2402/54

COORDINATION OF INTERNATIONAL SOCIAL SCIENCE RELATIONS MANDATED

Budapest AKADEMIAI KOZLONY in Hungarian 19 Jul 82 p 100

[Directive No 16/1982 (A. K. 6) MTA-F of the First Secretary of the Hungarian Scientific Academy Concerning the Creation of a Committee to Provide Coordination of International Contacts for the Social Sciences]

[Text] 1.

(1) In agreement with the leaders of the institutions listed in paragraph (3), Section 2, I establish a committee for the coordination of the international contacts of the social sciences.

(2) The Committee is an advisory, reporting organ of the first secretary of the MTA [Hungarian Scientific Academy].

2.

(1) The Committee is designated: Coordination Committee for the International Contacts of the Social Sciences.

(2) The chairman of the Committee is the social sciences deputy first secretary of the MTA.

(3) The members of the Committee are representatives of the presidium of the Hungarian Scientific Academy and its appropriate scientific departments and of the Ministry of Foreign Affairs, the Ministry of Culture, the State Wage and Labor Affairs Office, the Central Statistics Office, the Central Office of the Hungarian Scientific Academy, the National Plan Office, the Political Academy of the MSZMP and the Social Sciences Institute of the Central Committee of the MSZMP.

(4) The chairman of the Committee designates the permanent invited members of the Committee.

(5) The secretariat tasks of the Committee are taken care of by the International Contacts Main Department of the Central Office of the MTA. The chairman of the Committee appoints the Secretary with the agreement of the members of the Committee.

3.

The task of the Committee is to survey the situation of the international contacts of the domestic social sciences and analyse their developmental possibilities and to conduct decision preparing and coordinating activity in regard to:

(a) international social science research cooperation,

(b) planning and publishing joint publications,

(c) preparing Hungarian participation at foreign social science congresses of outstanding significance, and

(d) preparing the more significant international social science programs to be held in Hungary.

4.

(1) The sphere of its tasks and detailed rules for its operation must be fixed in the statutes of the Committee. The chairman of the Committee approves the statutes with the agreement of the members of the Committee.

(2) The statutes of the Committee must be sent to every organ participating in the work of the Committee.

5.

This directive goes into effect on the day of its promulgation.

signed, Lenard Pal

8984
CSO: 2502/86

SCIENCE POLICY COMMITTEE RULES ON R&D DEVELOPMENT PROGRAM

Budapest AKADEMIAI KOZLONY in Hungarian 19 Jul 82 pp 100, 101

[Position of the TPB (Science Policy Committee) Concerning 1981 Execution of the Research and Development Program of the OKKFT (National Medium Range Research and Development Plan) and Concerning Future Tasks]

[Text] 1. The experiences of 1981 confirmed that the programs figuring in the OKKFT can successfully serve:

--development of the economic infrastructure;

--modernization of the production structure and the adopting of new technical cultures; and

--laying a scientific foundation for and further developing our social and economic policy goals.

The programs can help the realization of the national economic goals of the Sixth 5-Year Plan and can contribute to laying the foundations for the economic and social policy goals of the Seventh 5-Year Plan.

2. The research and development programs of the OKKFT will be capable of successfully serving to lay research foundations for our social and economic policy aspirations if:

--initial failures experienced in the course of organizing execution are liquidated as soon as possible;

--one realizes in the course of fulfillment a differentiated guidance practice adjusting flexibly to the character of the programs and putting practical utilization in the center; and

--the responsible authorities carry out without delay and in a determined fashion the tasks which become necessary in the interest of this, that is, hinder the one-sided realization of administrative interests and liquidate the bureaucratic program guidance methods which can be experienced sometimes.

2.1 In the interest of this, the guidance of the programs must be made suitable for taking intervening changes into consideration in time. This requires that:

--the work of the organizations guiding the programs (program councils, program commissioners) should be more worthy and more flexible, adjusting to the character of the programs, and at the same time should be more determined;

--the financing of the programs should be better paced and flexible. We should avoid making the programs too rigid or over-determined by virtue of research and development contracts. We must provide opportunities for the necessary modifications, for abolishing tasks and taking up new ones. At the same time, care must be taken to provide the material cover for tranquil work, ensuring adequate foresight.

2.2 On the basis of experience thus far and in the interest of ensuring success there is a need for significant attitudinal and methodological changes in the case of executing market oriented programs with an immediate economic goal. In the interest of encouraging this:

--the previous one-sided state administrative guidance methods must be replaced by a guidance practice based on the enterprises interested in ultimate utilization of the results, counting more courageously on enterprise independence;

--in connection with the foregoing we should examine how the guidance of the research and development programs connected with central developmental programs might be made more simple, how the unnecessary guidance parallelism might be eliminated;

--in addition, we should examine, in the case of market oriented industrial programs or their sub-programs and in the case of individual projects thereof, how to make better organized the cooperation of various research, producing and marketing organizations, in the interest of the completeness of the innovation process. Special emphasis should be given to realizing the viewpoints of marketing.

2.3 In the case of research and development programs laying the foundations for social and economic policy decisions:

--care must be taken to see that those interested in research work, in defining and executing research goals, debate the conceptions being formed and the research results continuously at appropriate professional forums;

--the authorities responsible for the programs should review the experience thus far in the organization, guidance and research of the programs and should inform the TKB [as published] about this at an appropriate time;

--increased attention should be turned to practical utilization of the research results and recommendations born in the programs;

--it would be well to develop, on the basis of experience, a financing and guidance practice better adjusted to the character of the programs. In accordance with this care must be taken to supplement the guide regulating the direction and financing practice of the OKKFT programs as needed.

3. The practical orientation of the research and development programs of the OKKFT and the need for flexible adjustment to changing requirements justify having those responsible for the programs constantly inform themselves about fulfillment of the programs, taking the necessary action in time. To aid this and on the basis of an earlier resolution of the TPB, supervision of the execution of the programs must be developed further and must be made systematic; there must be continual attention paid to this.

Helping to organize guidance work which treats practical utilization as a central task, shortening the reaction time of guidance, cooperation in reducing the bureaucracy which can be experienced at times and making recommendations for the necessary measures should stand in the center of supervisory and assistance work.

4. The chairman of the OMFB [National Technical Development Committee], the first secretary of the MTA [Hungarian Scientific Academy] and the secretary of the TPB should aid execution of this position with continual organizing, coordinating work.

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SCIENCE POLICY COMMITTEE STAND ON RESEARCH TRAINING, SCIENTISTS' QUALIFICATION

Budapest AKADEMIAI KOZLONY in Hungarian 19 Jul 82 pp 101-103

[Position of the TPB (Science Policy Committee) Concerning Further Development of Researcher Training and Scientific Qualification]

[Text] The Science Policy Committee expresses its appreciation to the work committee examining the possibilities of modernizing scientific qualification. It takes cognizance of the finding of the Committee according to which a sudden, radical change of the system of scientific qualification would not be useful. Defining long term goals, however, is possible; attaining them will require a longer time. The Presidium of the Hungarian Scientific Academy and the Scientific Qualification Committee constantly attend to the experiences of scientific qualification and researcher training and will initiate modifications which become timely. Some of the measures recommended by the work committee can be worked out and implemented in a short time.

1. Taking the foregoing into consideration, the Science Policy Committee is asking the president of the Hungarian Scientific Academy and the chairman of the Scientific Qualification Committee to weigh the recommendations of the committee and make use of the experiences acquired in the course of applying the regulations adopted in 1970 and, in cooperation with the ministers supervising the universities, to submit drafts for new legal regulations for scientific qualification and researcher training. The time limits (for submission to the Science Policy Committee) are:

--September 1982, for a uniform regulation of researcher training, and

--June 1983, for regulation of scientific qualification.

2. The Science Policy Committee offers the following to be taken into consideration in working out the new provisions:

(a) An especially important task at present in the area of scientific researcher training and qualification is a consistent realization of the requirements and, thus, raising the level.

(b) Scientific qualification encourages scientific work, recognizes scientific accomplishment and thus recognizes ability to do scientific work. It is not suitable for the recognition of other merits.

(c) It is especially important and timely to create a uniform system of researcher training by combining the post-graduate scholarship and Scientific Further Training Scholarship system, in accordance with the thinking outlined in the attachment to the Position.

(d) The system of candidate's examinations must be reviewed and, if necessary, changed. In the course of this there must be an increase in the language requirements. The function of the candidate's ideological examination must be clarified, and how it fits into the state regulated system of political training. The substantive requirements of the several tests and the conditions for dispensing with them must be established--keeping in mind the necessity of raising the level.

(e) A dissertation, book, thesis summarizing scientific results or a description of a creation can continue to serve as a basis for awarding scientific degrees.

(f) A principled, consistent fulfillment of the requirements serving as a basis for awarding the degree doctor of sciences must be required. An attempt must be made to raise the scientific level. A study should be made of how to increase the role of scientific bodies in initiating competition for the doctor's degree.

(g) There must be further study of the question of the candidate's and doctor's salary supplement. Prescriptions pertaining to the salary supplement should be fixed by the provisions in a lower level regulation.

3. The Science Policy Committee is asking the minister of culture to review, in cooperation with the minister of agriculture and food and the minister of health affairs, the conditions for awarding the university doctor's title and to initiate the necessary modifications. The TPB offers the following as the chief goal of the review:

--a way to increase the requirements necessary for winning the doctor's title;

--the possibility of introducing a title recognizing initial scientific work at schools awarding the doctor's title together with a university diploma (medical, veterinarian and law schools);

--making uniform the examination requirements and the taking of examinations necessary for winning the doctor's title and the candidate's degree.

The modification should serve to harmonize the requirements constituting the basis for the candidate's degree and the doctor's title and should serve to make the awarding of them uniform in the long run.

Time limit: June 1983.

4. The TPB is asking the first secretary of the Hungarian Scientific Academy to see to the evaluation of the ideas in the conception and, if possible, to their implementation within the framework of the study ordered by TPB resolution 30.009/1981.

5. The Hungarian Scientific Academy and the Scientific Qualification Committee should work out a plan, bringing in the interested supervisory organs, to work out proposals containing the modifications and to prepare for the implementation of the new provisions.

Time limit: July 1982.

Attachment to the Position of the TPB

A Conception for a Uniform System of Researcher Training

1. Researcher training is a part of the postgraduate further training of experts with university diplomas. The goal of the training is: to prepare young experts with a knowledge of science and capable of cultivating it who are capable of independent scientific work for modern, high level work in higher education and for practical application of the achievements of science (for developmental work). The success of the further training finds expression in winning the candidate's degree or the university doctor's title. The time of the training is at most 3 years.

2. The training takes place in university or college institutes or faculties and in research institutes suitable for it (hereinafter, research site). The Presidium of the Hungarian Scientific Academy designates at appropriate intervals research sites suitable for the training, taking into consideration the recommendation of the leader of the supervisory organ. The TPB establishes the ratios, by authority or by branch of science, of the scholarship students which can be admitted to the research sites under the supervision of the several authorities.

3. Admission takes place on the basis of a national competition, which is announced by the Scientific Qualification Committee. The application must be submitted to that research site where the applicant seeks training. The research site rank orders the applicants and the Scientific Qualification Committee selects those to be admitted from among those recommended for admission by the research site.

4. Experts younger than 35 years of age, with a university diploma, can compete. Applicants with practical professional experience will have the advantage if they have the same professional level. A study must be made of under what conditions experts graduating from a college may compete.

5. The TMB will establish a work relationship with scientific scholarship students admitted immediately after graduating from a university. Scholarship students already employed, admitted from another place of work, will have no work relationship at their previous place of work during the period of their scholarship. Care must be taken to place people who have participated in training after the completion of their scholarship.

6. Correspondence researcher training must be maintained and expanded. (A study should be made to see if the scholarship or correspondence form of organized researcher training should become the basic path to winning a

candidate's degree). Point 4 in regard to conditions for the competition is the guide for correspondence researcher training also.

7. The present system of foreign researcher training should be maintained and, if possible, expanded; this should be achieved within the framework of interstate agreements and through training at the burden of the foreign institutions.

8. The legal standing of persons participating in domestic researcher training corresponds to the legal standing of scientific assistants; their scholarships should be established uniformly within the wage item for scientific assistants. The enterprise or institution sending them can supplement their scholarship--on the basis of an agreement made with the person on the scholarship.

9. The research site sees to providing conditions for the work of the scholarship students and to scientific guidance and supervision of their work, it being institutionally responsible for the training of the scholarship student. A leader is designated to guide and supervise the individual program of the scholarship student. The organized nature of the training should be increased via special collegia and seminars.

10. In the course of their training the scholarship students take tests corresponding to the candidate's test requirements and prepare their dissertations. The research site responsible for their training (its scientific council or the appropriate university body) decides whether the dissertation should be submitted to win a university doctor's title or a candidate's degree.

11. The following resources should be used for scholarship training:

--the financial frameworks for scientific further training scholarships;

--the financial frameworks available for domestic graduate student scholarships;

--scholarships which can be established by enterprises and institutions.

12. The system for researcher training should be worked out and the preparatory work should be done in such a way that the competition can be posted by December 1982 and that training in the new system can begin in September 1983. Domestic graduate student scholarships for 1983 need not be announced.

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END

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East Europe Report

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EAST EUROPE REPORT

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REPORT ON WORK, ACHIEVEMENTS IN FIELD OF GENETICS

Achievements in Medical Genetics

Sofia SUVREMENNA MEDITSINA in Bulgarian No 6, 1982 pp 342-346

[Article by M. Tsoneva and Br. Ts. Bratanov. Paper submitted at the First National Congress on Medical Biology and Genetics, 13-15 November 1981]

[Text] During the 5 years since the second national conference on medical biology and genetics, which was held in 1976, scientific research in the field of medical genetics was expanded and intensified in Bulgaria.

The basic scientific studies conducted during that period were focused on the following:

a. Determining the genetic status of the Bulgarian population;

b. Establishing the clinical-genetic polymorphism of existing hereditary diseases;

c. Studying environmental factors as possible mutagenic agents, inducing new chromosomal and hereditary pathology.

The studies of the genetic status of the Bulgarian population cover both the nature and frequency of normal genetic human markers and the various hereditary and chromosomal pathology.

Fruitful and extensive studies were made on the characteristics and frequency of leucocytic antigena in our population, by a collective headed by Dr Minev. In addition to their theoretical value, these studies are directly related to clinical and practical health care problems.

The rapidly developing knowledge in the field of genetic polymorphism of enzymes, sera and other antigena and protein fractions has been the reason for extensive population studies of the dissemination of such genetic markers in the Bulgarian population and a contribution to its anthropological characterization.

Studies were made of genetic polymorphism and frequency of polymorphic alleles of phosphoglucomutase (PgM_1) (Kalchev), glyoxalase$_1$ (Popova), adenosine deaminase (Nenkov), esterase D (Rupcheva and Peev), post-transferrins (Pavlov), two aminotransferases, three oxyreductases and aldclase (Yaneva), the alpha$_1$-antitrypsine fraction (Tsoneva, Toncheva et al.), and others.

The dermatoglyphic studies of healthy individuals in our population (Karev), Duffy alleles (a, b, amorphen) and the secretion type in populations in various parts of the country (Tsoneva, Ilieva et al.) were contributions to the study of the normal genetic status of our population.

Problems of genetic polymorphism were developed on the chromosome level as well. Original studies include those on chromosome polymorphism (RV, C, Ag) in the Bulgarian population and its characteristic features in the various age groups (Tsoneva, Krachunova and Tsancheva).

Let us also emphasize the original studies made by G. Manolov and Ya. Manolova on improving the possibility of identifying human chromosomes through the use of prometaphasic chromosomes to this effect. This method enables us to determine a larger number of the ribbon differentiation of chromosomes and increases opportunities for chromosome diagnosis.

This period was characterized by extensive population studies of chromosome diseases in our country, hereditary degenerative diseases, some blood diseases (hemoglobinophies, G6 PD insufficiency, and hemophilia), some mental diseases, mucoviscidosis, phenylketonuria and galactosemia, hereditary blindness, hereditary deafness, Balkan endemic nephropathy, essential hypertonia and ischemia, sugar diabetes and others.

Physicians-geneticists, pediatrists, neurologists, psychiatrists, internists, ophthamologists, nose-ear-larynx specialists and others participated in the development of these broad genetic and clinical problems. This is a pleasing fact, for it indicates the direct penetration of genetics into clinical medicine, which leads to the rapid application of contemporary medical genetic achievements in practical health care.

It was established that 0.67 percent of newborn children suffer from chromosome diseases. Joint studies (Kushelov, Tsoneva et al.) conducted with Soviet scientists have indicated certain differences in the characteristics in chromosome pathology in our country. The Bulgarian population is characterized by a lower frequency of sex chromosome diseases and structural chromosome disturbances and a relatively higher incidence of trisomia 21.

Thirteen different chromosome defects, 5 of which are particularly rare, were discovered; among them partial trisomia 15q distale is a characteristic of a new chromosome syndrome. The nature of the mosaic forms and balanced translocations--which are important in the hereditary inheritance of chromosome diseases--was clarified.

Joint studies with Soviet researchers (Kuleshov, Tsoneva, Krachunova and Vulkova) determined that chromosome diseases account for 24.6 percent of all cases of inborn anomolies and degeneracies and 72 percent of stillborn cases.

The frequency of spontaneous mutations in the somatic cells of the population was determined: 0.94 percent, of which 0.84 percent are structural and 0.10 percent are number mutations.

In our overall assessment of cytogenetic studies conducted in our country, let us emphasize the original contributions of Manolov et al. in the cytogenesis of some malignant formations (Burkitt's lymphoma and leucoses). In Burkitt's lymphoma of the African and non-African types we see the systemic participation of chromosome 8, various fragments of which are translocated to individual chromosomes.

Comprehensive studies have been made of the incidence and nature of degenerative neurological diseases (Abadzhiev et al., Georgiev et al.), providing a complete population genetic characteristics of degenerative neurological diseases in Bulgaria. No such comprehensive studies have been made abroad. This is the first time in which neurological literature has described the incidence and gene frequency of autosome-recessive neural muscular atrophy, the AD and AR form of Schrumpel's disease, AR multiclonic epilepsy, myatrophic ataxia, and dyssynergia cerebellaris myoclonica (Hunt's disease).

From the clinical-genetic aspect, some interethnic characteristics of some inherited forms of progressive muscular dystrophies were identified. Clinical and biochemical criteria were applied to discover the carriers of X-recessive progressive muscular dystrophy (Yankov).

Comprehensive population-genetic studies (Krachunova et al., Milenkov et al.) of manic-depressive psychosis determined in 10 okrugs the frequency and genetic characteristics of the disease. This led to a determination of the frequency of bipolar and monopolar forms of the disease; the genetic heterogeneity of the psychosis was confirmed; for the first time the AR type of inheritance in monopolar manic-depressive psychosis (periodical depression) was determined.

Hemoglobinopathies and G6FD insufficiency are of particular interest in terms of our population.

Considerable contributions were made in the study of the incidence of hemoglobinopathies in our country during that period with the works of the Hematology Institute (Rashkov et al.), the Chair of Medical Genetics (Tsoneva, Mavrudieva, Toncheva, Lalchev), the Pediatrics Institute (Sh. Nin'o and Spasov), Cholakov at the Burgas Okrug Hospital, and others.

The studies indicated that there is a high incidence of hemoglobinopathies in our country. The incidence of thalassemias is particularly high (about 10 percent average heterozygotic carriers).

Among patients suffering from undetermined anemias 35.8 percent included hemoglobinopathies, 96.9 percent with a thalassemic syndrome and 3.1 percent with structural anomalies of the hemoglobin and mixed forms. These diseases are most widespread in southeastern Bulgaria and in our southern areas.

Descriptions were made of a variety of forms of thalassemias, including alpha-T (H), Leporet-Boston, Leporet-Washington, structural Hb mutations, O-Arabia, D-Punjab, Koln, etc. Particularly high, compared with other countries, is the incidence of O-Arabia Hb among our population.

These exceptionally valuable studies are of major theoretical importance in connection with the evolutionary factors which have shaped the genetic stock of the populations. They are also of great practical importance in terms of our health care.

The initial data on the incidence of hemophilia among children, obtained by the collective headed by Sh. Nin'o, are a contribution to the population-genetic studies of hematological hereditary diseases in our country. Along with the established gene frequencies and type of inheritance, the results of such studies are a valuable contribution to clinical polymorphism of hemophilia in Bulgaria.

Extensive population-genetic and clinical-genetic studies have been done on G6FD insufficiency in our population (Tsoneva, Mavrudieva, Toncheva, Lalchev). These studies established the high frequency of G6FD insufficiency among our population: 4.1 percent hemihomo- and heterozygotic carriers among adults.

The high frequency of the defect among the newly born, compared with adults, was determined.

The genetic polymorphism of the G6FD gene was studied, in accordance with the WHO program. Thirteen different variants were identified, four of which were new. In the course of comprehensive studies with the collective of the Medical Genetics Institute in Moscow (Shchatskaya, Krasnopol'skaya) comparative studies were made of the G6FD variants in the Bulgarian, Russian and Azerbaijani populations, showing characteristic differences in the polymorphic nature of this genetic system, constituting a theoretical contribution to anthropogenetics.

Correlations of incidence of G6FD insufficiency with the altitude and endemic malaria in the past among our populations and with other genetic systems of the Th, Rh secretory type (Tsoneva et al.) have been established.

For the first time in our country we have established the role of G6FD insufficiency in the development of neonatal hyperbilirubinemia (Tsoneva, Novachev, Nacheva, Khatzhimekhedova et al.). About 20 percent of neonatal hyperbilirubinemia in our newborn is caused by G6FD insufficiency.

This theoretically and practically important problem in terms of our population (neonatal hyperbilirubinemia) was extensively studied by Novachev, who assessed the various genetic factors such as ABO and Rh incompatibility and G6FD insufficiency in the pathogenesis of neonatal hyperbilirubinemia in Bulgaria.

The role of G6FD insufficiency as a lethal and sublethal factor in our population was exposed. These extensive and systematic studies, which were summed up in the monograph "G6FD Nedostatuchnost v Bulgariya" [G6FD Insufficiency in Bulgaria] (M. Tsoneva, editor), are a theoretical contribution to the

anthropogenic characteristics of our population and are of direct health and social importance in all areas of our practical health care system.

During that period, mucoviscidosis, a hereditary disease which is not sufficiently appreciated in our country in terms of its comprehensive clinical importance, was the subject of population-genetic studies.

The gene frequency of mucoviscidosis was determined in some parts of the country and for the first time in the literature a description was provided of increased chromosome aberrations in the carriers of the mucoviscidosis gene, which is related to changed homeostasis in patients (Lukanov, Tsoneva, Radanova, Anadoliyska, Petkov and Andreeva). Data on the frequency of diabetes (Genkova, Tsvetkov) and of essential hypertonia (Tsonev, Kurnolski) in some parts of the country contribute to the population studies of hereditary diseases in the country.

Studies related to hereditary and congenital diseases, which lead to blindness in our population, carried out at the Institute for Eye Diseases (Dubov, Filipov) are of particular scientific value and significance in terms of health care. Hereditary factors play a role in 73.1 percent of the development of blindness in Bulgarian children. Such a study of the corresponding nosology and type of inheritance reveals valuable scientific facts of theoretical and important practical significance in the struggle against blindness in our country.

The laboratory for biochemical diagnosis of hereditary diseases, which was newly created under the Pediatrics Institute, undertook the implementation of a program for a mass screening for phenylketonuria and galactosemia, which will provide data on the frequency of these metabolic hereditary diseases among the population and will make it possible to undertake their treatment and prevention (Stanchev, Kalaydzhieva et al.).

During that period studies were made of the frequency and nature of congenital malformations in the various parts of the country: Pazardzhik (Kuyumdzhiev), Yambol (Karadimova), Ruse (Petrova), Sliven (Zheliyazcheva), Tolbukhin (Dzhenev and Georgieva) and others.

These studies indicated an increasing trend of congenital malformations in our country, a fact which is familiar on a worldwide scale, and which triggers justifiable concern.

Significant efforts are focused in scientific research on problems of clinical-genetic polymorphism of hereditary pathology and the role of genetic predisposition in pathological developments.

Systematic and profound studies are being made in this respect at the Ear, Nose and Throat Diseases Institute (Pavlov, Ficheva et al.) on hereditary audial pathology. These studies reveal the phenomenological characteristics of different nosological units such as mucopolysacharidoses, osteogenesis imperfecta tarda, the Lawrence-Moon-Bidle, Uscher, Waardenburg and other syndromes in the development of hereditary deafness.

The type of heredity--AD, AR--was described and, using the most advanced audiometric methods, the intrafamily correlation and interfamily variability in the characteristics of audial disturbances were clarified.

Electron microscope studies of platella from the stirrup-bone (Pavlov, Tsenev, Ficheva, 1981) were a contribution to the clinical picture and pathogenesis of van der Hoeve's syndrome.

In addition to their theoretical values, these studies offered practical approaches for early audial rehabilitation and prostheses, which are particularly important in terms of the social adaptation of the deaf to society.

Comprehensive studies of the clinical-genetic polymorphism of G6FD insufficiency (Chair of Medical Genetics, Pediatrics Institute, Higher Medical Institute in Plovdiv and Pleven) proved the role of some genetic variants (Mediterranean, Corinthian, Seattle) in the development of specific pathologies--favism, neonatal hyperbilirubinemia, induced hemolitic reactions, chronic and acute hemolitic anemias, etc, affecting our population.

Noteworthy studies have been made of the role of some genetic markers in the development of a predisposition for diseases using multifactor etiology. They were carried out in terms of the HLA system, G6FD insufficiency, secretional type, loss of taste, diabetes, thyrotoxicosis, schizophrenia, hypertonia, ulcers and others, conducted by various researchers (Minev, Genkova, Tsoneva et al., Kurnolski, Ilieva and others).

In this connection, dermatoglyphic studies must be considered genetic markers. They were carried out in the case of some eye diseases (Filipov, Stoykova), congenital heart diseases (Markova), some chromosome diseases (Kaleva) and others, which are of essentially theoretical significance and whose diagnostic value is insufficient.

Interesting studies were conducted during that period on the role of genetic factors in Balkan endemic nephropathy. Two independent groups (Mikhaylov and Markova and Boyadzhieva) proved AD-type heredity in this serious and mysterious disease existing in our country with convincing data. The results are rated highly. They offer a new strategy in our diagnostic and prophylactic approaches to the disease.

Other contributions to clinical genetics are the studies of hereditary lysosomic diseases and the large number of new diagnostic methods related to molecular diseases in our country, applied for the first time (Kalaydzhieva, Varon) are a contribution to clinical genetics. particularly useful in clinical cytogenetics were the use of bending techniques in some cytogenetic laboratories in Sofia--the Medical Genetics Chair (Georgieva, Tsancheva), the Oncological Institute (Manolov) and the Higher Medical Institute in Plovdiv (Vulkova, Genev). In this respect the monograph "Khromozomana Diagnostika" [Chromosome Diagnostics] (M. Tsoneva, editor) was useful. The introduction of the SCE (sister chromatoid exchanges) in the study of diseases related to chromosome instability (Georgieva) is an entirely new and promising direction in clinical genetics. In such studies, research on the level of SCE in man in different ontogenetic age groups (Tsoneva, Georgieva, Yulzari) is of particular theoretical and applied value (norming criteria).

This brief enumeration of studies and applications in the field of clinical genetics offers optimistic prospects regarding its future development. Medical genetics in our country is lagging behind our medical science and health care in only one essential aspect--the application and development of prenatal diagnosis, which is particularly necessary and valuable in the prevention of hereditary and chromosome pathology.

During the period under consideration, a large number of studies were made on problems of induced mutagenesis. Such studies combine the qualities of basic research and possibilities of direct practical application of results.

Problems of mutagenic characteristics of radiations were developed (Ivanov, Bayrakova, Vuglenov et al.), of possible protectors (antimutagens) in experiments and in individuals threatened with radiation, and others.

Direct studies were made of some biological factors such as toxins (Chan Thi Lien), viruses (Minchev) and autoimmune homeostasis (Krachunova). Extensive studies were made involving chemical mutagens, pesticides (Tsoneva, Georgieva, Dant Chi Than et al.), some medical compounds (Tsancheva, Georgieva, Ivanov), and industrial toxic substances such as vinylchloride, polyvinylchloride, styrene, and others. The SCE methods which were applied as a mutagenic test in the study of lymphocyte cultures in man (Tsoneva, Georgieva, Chan Thi Lien, Ivanov) as well as in vivo on animals (Syrian hamster and the cotton rat) were of particular value in enhancing the level of research in the field of induced mutagenesis.

Studies of professionally endangered groups of individuals in the chemical industry, which have led to the application of prophylactic measures whenever necessary, have been of particular value in the prevention of heredity and chromosomal diseases.

Studies of mutagenic characteristics of environmental factors in our country are included in the CEMA scientific program, and Bulgarian researchers are valued and respected partners in cooperative work on such problems.

The main directions which characterize these studies proved to be accurate and fruitful. They were included in the scientific coordination program "Genetic Status of the Bulgarian People and Factors Which Induce Mutations of the EMBF, which was set up in Bulgaria in 1980 in accordance with the CC of the BCP decrees on the development of medical science and cadres.

These directions must be consolidated and enriched through new nosological units. The diagnostic methods for the detection of hereditary and chromosomal diseases, particularly those involving prenatal diagnosis, must be improved.

A particularly important feature in the development of medical-genetic studies and the fast practical utilization of results are the organizational approaches adopted in their solution and, not least, the erudition of the scientific cadres.

These organizational approaches have been established--maximal integration of the cadre potential with specific scientific directions leading to the effective solution of the problems.

Medical-Genetic Consultation

Sofia SUVREMENNA MEDITSINA in Bulgarian No 6, 1982 pp 353-355

[Article by M. Tsoneva]

[Text] medical-genetic consutation (MGC) is a link within the health care system, whose task is to promote the prevention of hereditary and chromosome diseases.

In our country's health care system the MGC are controlled on the basis of the 1947 order of the minister of public health.

The MGC uses in its activities all achievements of general and medical genetics. Its activities are focused, on the one hand, on the family and the offspring and, on the other, the population.

Within the framework of the family, the MGC provides a genetic diagnosis of the respective disease which is the reason for the consultation and offers a prognosis on the risk of giving birth to a sick or damaged child in the respective family.

The MGC does not impose its decision on the family but provides advice regarding the actual dangers. The independent decision is made by the family in terms of the health and fate of its offspring. This form of medical-genetic consultation is defined as "passive" MGC, unlike activities aimed at the population, which are described as "active" MGC.

The active form of MGC is based on mass studies, screening programs, genetic monitoring, etc, organized and actively guided by the MGC.

The work of the MGC in limiting the birth of sick children suffering from hereditary and chromosome diseases has made extensive use of and contribution to prenatal diagnosis during the past decade.

With the help of prenatal diagnosis, which detects the chromosome or hereditary disease in the embryo, the possibilities of the MGC expanded. The birth of a healthy child became no longer and question of probability but of real possibility.

The problems of the MGC and prenatal diagnosis were the subject of a meeting of the First National Congress on Medical Biology and Genetics held in Bulgaria (13-15 November 1981). In addition to the papers submitted by Bulgarian authors, papers were submitted by a large number of foreign participants [all foreign names transliterated] such as Dr Machek, Prague; Dr Pelts, Rostok; Dr Weiss, Magdeburg; Lozanova and Tsinger, Berlin, GDR; Yokel, Gatersleden; and Metaxotou, Athens.

In terms of topics, the papers may be classified into three groups:

a. MGC and selective screening experience in our country (Tsoneva et al.; Khristozova et al.; Simeonov et al.).

b. New methods and clinical approaches in diagnosing hereditary and chromosome diseases (Kremenski et al.; Lalov et al.; A. Kaleva).

c. Experience and successes in prenatal diagnosis (Machek, Pelts et al.; Weiss et al.; Metaxotou et al.; Lozanova and Tsinger, Yokel).

a. Between 1975 and 1980 more than 7,000 patients were subjected to MGC at the Chair of Medical Genetics in Sofia and 2,539 at the Higher Medical Institute in Plovdiv. The pathology subject to MGC was evaluated.

The highest frequency of reasons for MGC were chromosome diseases, degeneracies and congenital anomalies--35.32 percent, followed by reproduction failures (spontaneous abortions, stillborn)--18.13 percent. In terms of frequency they are followed by neurological diseases, 9.37 percent; hereditary blood diseases, 8.86 percent; mental diseases, 8.86 percent; internal diseases, 4.02 percent; metabolic, 2.16 percent; skin, 1.59 percent; eye, 1.24 percent; ear, 1.13 percent, and others (radiation damages, clinically unexplained cases, nonhereditary diseases), 5.25 percent.

A study of the sources of information which led the patients to MGC indicates that 48.09 percent of them were directed by a medical institution, no more than 7.28 percent by the polyclinics and 12.30 percent by medical personnel; 11.33 percent came on their own initiative and the source of information for 28.22 was not determined.

These data indicate the poor familiarity with the possibilities of MGC and their use on the part of medical workers in our polyclinics.

MGC would play a most important role in giving advice even before marriage in the case of individuals with hereditary pathology in order to prevent severe consequences to the family and society. The assessment of our experience on this level indicates that 98.56 percent of the consultations were postmarital and only 1.44 were premarital. The family seeks MGC at least after one misfortune. In 50 percent of the cases premarital consultations applied to mental illnesses, marriages between blood relatives, deafness, congenital luxation of the pelvic joint, i.e., diseases or situations which are quite clearly manifested in the family and society.

The application of the practical results of MGC in prenatal diagnosis is suffering from a considerable lag. Our initial successes in this respect were optimistic. In 1981 the first healthy child as a result of the application of prenatal diagnosis in the country was born. It was a case of a family with a single child with a severe hereditary chromosome disease, which was described for the first time in world literature (Tsancheva et al., 1981), with a high risk that other sick children would be born as a result of balanced translocation in the mother.

Our MGC includes genetic monitoring of professionally threatened groups from the effect of strong mutagenic agents and the use of preventive measures for the protection of gametogenesis and restricting a new outbreak of hereditary and chromosome pathology.

The range of the active form of MGC also includes studies of the role of genetic factors in mentally retarded children (Simeonov et al.) and selective screening for phenylketonuria and galactosemia (Kalaydzhieva et al.).

b. The second group of papers dealt with methodical problems of laboratory diagnosis of mucobolysacharidoses and mucolipidoses, clinical criteria in directing the patients to chromosome diagnosis, and the possibility of dermatoglyphics in diagnosing chromosome pathology.

c. Particularly rich and varied data were submitted based on the experience in the application of prenatal diagnosis in countries such as the GDR, Czechoslovakia and Greece.

Dr Machek from Prague reported on the results of prenatal diagnosis in Czechoslovakia, which covered about 2,000 cases. It has been applied since 1971. The main group (70 percent) of cases with prenatal diagnosis were based on indications of chromosome disease; 18.4 percent on defects in the neural tube, 3.8 percent of metabolic hereditary diseases, individual cases of mucoviscitosis, radiation risks, and others.

Docent Weiss shared the experience of his group based on 1,020 prenatal diagnoses made in Magdeburg. As a result of the data in 5.4 percent the pregnancy was interrupted as a result of the establishment of hereditary and chromosome diseases in the embryo. In real terms, this meant the prevention of the birth of 54 abnormal children.

Dr Pelts shared the experience of a group working in prenatal diagnosis in the city of Rostok in the GDR. This group includes gynecologists, geneticists, biologists and chemists. Dr Pelts emphasized that prenatal diagnosis is an interdisciplinary area which requires the joint efforts of specialists in different fields. In Rostok prenatal diagnosis has been applied since 1975 and the experience of the group is based on 282 pregnancies submitted to prenatal diagnosis. The characteristic feature of their approach in indications of prenatal diagnosis is to include in the risk group not only the mothers but the fathers, requiring the prenatal diagnosis in advanced age. The main group of prenatal diagnoses are based on indications of actual risk of the birth of a child with chromosome disease in more than 70 percent of the cases. In terms of incidence, this was followed by defects in the nervous tube--16 percent; congenital metabolic errors--1.4 percent, etc.

Lozanova and Tsinger reported on the results of 192 prenatal diagnoses in Berlin, GDR.

Dr Metaxotou et al. reported on 460 prenatal diagnoses in Athens. Prenatal diagnosis has been practiced in Greece since 1976.

The rapid popularity gained by prenatal diagnosis among society was stressed: it was practiced on six families in 1976, 142 in 1980 and 155 in the first 7 months of 1981 alone.

The main group of pregnancies with prenatal diagnosis was based on indications of the danger of chromosome diseases. In 4.7 percent of the prenatal diagnoses of pregnant women of an advanced age embryos with chromosome disease were diagnosed. In the course of the debates Dr Metaxotou pointed out that prenatal diagnosis of hemoglobinopathies is extensively applied in Greece, as they have a high incidence among the population. In this area of prenatal diagnosis another group is successfully working and is enjoying great popularity among the people.

The report by Yokel, from the Genetics Institute of the GDR Academy of Science in Gatersleden was of great interest.

He submitted preliminary results of his studies on prenatal diagnosis and the discovery of heterozygotic carriers of mucoviscidosis. This problem is exceptionally topical. Mucoviscidosis is a widespread hereditary disease among European populations and is the reason for a considerable rate of mortality in neonatal and early childhood. The study is focused on five lysosomic enzymes and alkalai phosphatase, which have been studied in terms of their specific activeness and some physical and chemical properties in cultures of skin fibroblasts in suspected individuals.

The results obtained are very encouraging and earmark possibilities of applying prenatal diagnosis in mucoviscidosis, which is of great health, social and economic significance.

In the course of the session a number of discussions took place on a high scientific level. They indicated the seriousness of the problems of MGC and prenatal diagnosis and their significance in terms of practical health care. Through MGC and prenatal diagnosis successes in medical genetics find a real application and yield results in the reduction of infant mortality, and the prevention of the birth of heavily damaged and defective children afflicting the family and society. In addition to its health and social aspect, this problem involves major moral and ethical aspects which must be emphasized.

The MGC and prenatal diagnosis problems which were raised and discussed at the First National Congress on Medical Biology and Genetics contributed to the clarification of these problems among our medical society and are a contribution to the extensive application of the contemporary successes in medical genetics in our practical health care.

5003
CSO: 2202/16

FLEXIBLE WORK CELL FOR MACHINING OF PRISMATIC WORKPIECES DESCRIBED

Bern TECHNISCHE RUNDSCHAU in German Vol 74 No 17, 27 Apr 82 pp 17, 19

[Article by U. Franz, engineer, VEB Fritz Heckert Machine Tool Combine, GDR 9039, Karl-Marx-Stadt: "Flexible Work Cell for the Complete Machining of Prismatic Workpieces--Minimum Attendance Operation With Integrated Measuring Functions"]

[Text] For the complete processing of prismatic small parts up to an edge length of 400 mm there has been developed a flexible manufacturing cell which is new and unconventional in its construction and mode of operation. Basically it is capable of functioning with few operating personnel to produce workpieces of stable quality. To this end measurement pickup devices are used in addition to thermal and optical surveillance equipment. The reduction of operating personnel is a consequence of the basic design of the machine and of the automation of hitherto neglected auxiliary functions. The design simultaneously solves problems involved in new configuration of workplaces and environmental problems. This system is advantageously influenced by harmonizing the machine with a new method of guidance.

It has been possible for both users and manufacturers to gather extensive experience from the use hitherto of processing centers. These form an important foundation for meeting demands for further development of new manufacturing facilities. Of elementary importance is the requirement for a process-optimal configuration, particularly in the domain of hitherto neglected auxiliary functions, for example, that of process lubrication and process cooling or the elimination of waste material from the work area. These questions are directly related to the minimization of operating and maintenance cost as well as to maximum protection of the operator from workroom dangers or from flying metal shavings and sprayed coolant.

There is a further important demand: namely, for the achievement of working accuracy not only under favorable conditions involving well-defined thermal machine conditions but also with high manufacturing stability at the highest possible statistical reliability of the required IT class in fully automatic operation and without continuous regulatory intervention on the part of the operator.

These requirements must also include the automatic establishment of prerequisite conditions for attaining work quality by means of measurement and quality control facilities as well as other appropriate measures.

These requirements can be met only with difficulty and by means of complicated devices when one is employing the conventional structures of processing centers. Therefore in designing the manufacturing cell presented here entirely new paths were opened up.

The development of guidance technology, especially its miniaturization, and the design maturity of decisive automating structural groups created the prerequisites for a "compact construction" which departs from the hitherto conventional individual setup of functional construction groups and methods of guidance and combines all of these into a "monoblock" occupying a minimal setup area.

A Broad Working Domain Is Included

Extensive investigations of the partial spectrum of the metal processing industry have shown that a large fraction of all prismatic parts including both edge parts and shaped parts may be included within a cube having an edge dimension of 400 mm. With axial paths of 480 mm it is possible for this cube to be reached from all sides by a tool having a diameter of 80 mm. The most important data for the flexible manufacturing cell are listed in Table 1. In part it may be inferred from this table that it is possible to perform economically all milling, boring, threading, countersinking and boring out operations with the tools used for these purposes today. The working material processed ranges over cast iron, steel, light metal and metal alloys as well as plastics.

Table 1. Most Important Technical Data for the Manufacturing Cell FCP 250

Chucking area (palette)	mm	400 x 500
Displacement paths x, y, z	mm	480 x 480 x 480
Workpiece weight	N	1,500
Spindle cone	SK	45
Rpm range	min^{-1}	20 to 4,500
Maximum driving power	kw	13.5
Maximum turning moment	Nm	440
Speed, fast forward	m/min	15
Automatically changeable tools	Number	40
Approximate area requirement	m^2	18

Construction and Function Are Simple and Practical

The exterior shape of the manufacturing cell FCP 250 is shown in Figure 1. Figure 2 explains the main construction of the actual work unit, especially with regard to the distribution and arrangement of the axes.

The workpieces are chucked on palettes at the chucking and tilting station (Figure 3) located at the right-hand frontal side. This is accomplished with

the receiving area being in a horizontal position. The chucking elements and devices are fastened by means of a cross-slot system.

Figure 1. Overall view of the FCP 250 manufacturing cell (Wema Auerbach, GDR).

After the chucking process has been completed by the operator the workpiece carrier tilts into a vertical position. After that there opens up the palette lock through which the workpiece carrier is brought into the rear portion of the workspace onto the side of a double-armed palette changer which is turned to face the transfer position of the processing station (Figure 4).

While the other receiving arm of the palette changer remains free in expectation of the return motion of the processed workpiece the temperature of the readied workpiece is brought to the processing temperature (preheated) by spraying it with a coolant which has been warmed by the process.

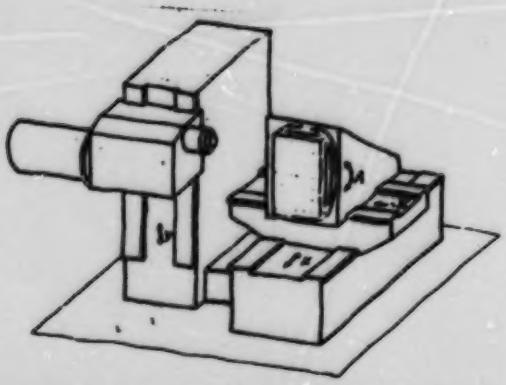

Figure 2. Construction of the basic machine FCP 250; distribution of the axes.

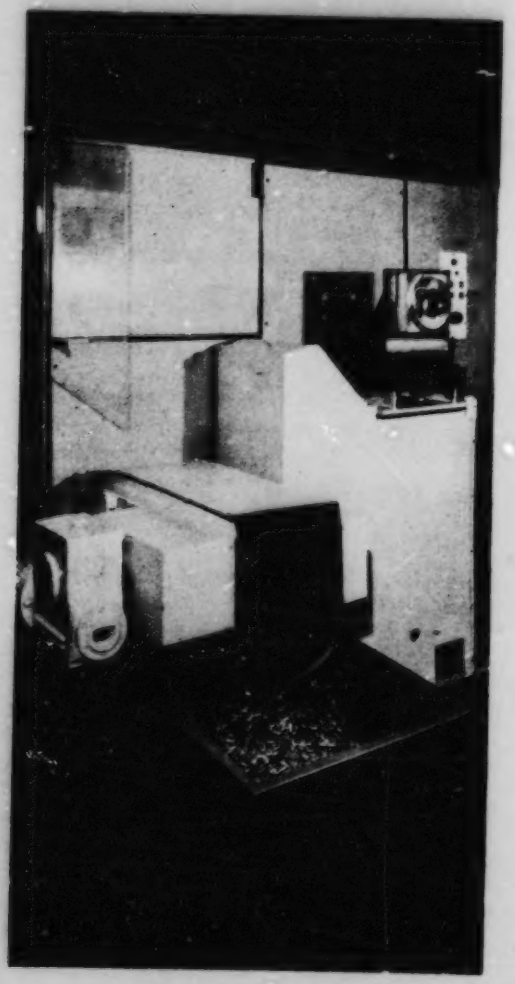

Figure 3. Chucking and tilting station.

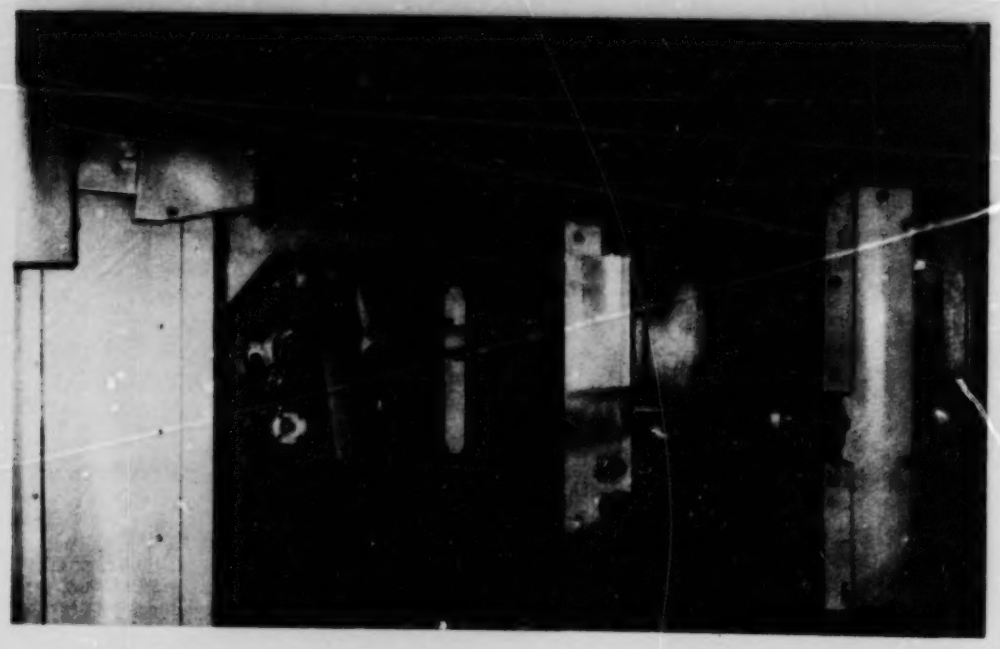

Figure 4. View into the workspace in the direction of the workpiece flow. In the foreground the palette changer; behind that the working spindle and tool-changing arm.

After the program-processing and after moving into the changing position of the sled system a transport facility pulls the finished workpiece with its palette onto the changer. A 180° turn about a horizontal axis and the subsequent shift of the new palette onto the machine-side reception characterize the automatic changing process. While the new workpiece is being processed the one which has been worked is moved in the opposite direction back to the chucking site and can be replaced independently of the latter.

For the processing it is possible to use the flexibly storage-location coded work tools in arbitrary sequence. Four cooling nozzles arranged in circular symmetry and distributed over a conical region centered on the midline of the main spindle are adjustable and guarantee a cooling and lubricating effect adaptable to the greatest lengths of the tools (Figure 5).

This effect can be further differentiated by two pressure stages. Metal shavings are in this way simultaneously removed over the most rapid and direct path from the workpiece and from its supporting and moving structural components; these metal shavings drop together with the used coolant into the metal shaving transporter which is located directly under the work site. Here the coolant is separated out when it trickles into a container lying below.

From there when necessary it passes via an externally placed moving belt filtering automatic apparatus into a cooling device situated above in order that it may continue to circulate at a constantly low temperature. In order to

avoid muddy deposits in the coolant chamber the medium is whirled through spray nozzles and transported to the outside via the pumping system together with the general circulation.

Figure 5. Work spindle head together with program-adjustable coolant nozzles built into the frontal side of the sledge.

Consistently with the requirements that powerfully injected and large coolant volumes must be kept under control the workspace is fully encapsulated (Figure 6) with fixed and movable protective equipment. Openings, for the most part closable, are present only for automatic workpiece changing or tool changing, for the intervention of the double-armed changer and for the removal of shavings in the area of the transporter. In this way with the help of a ventilator there is obtained in the interior a stable microclimate to secure small temperature differences for a workpiece precision which is uniformly high and which depends little upon time.

Working along these lines are temperature sensors attached to the support which signalize the presence of a uniform support position such as required for precision processing.

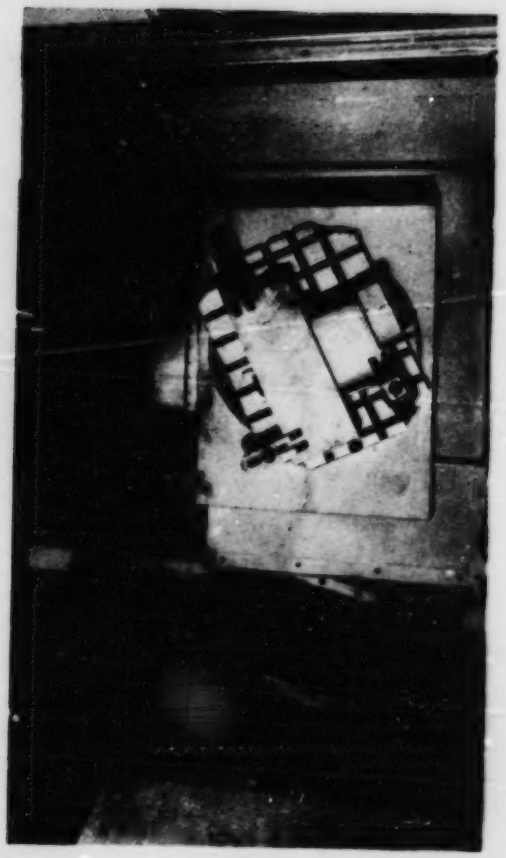

Figure 6. View into the fully encapsulated workspace. In the background the palette with workpiece chucked in place together with the working spindle and above left the tool-changing arm.

The principal drive is to a special degree designed for thermal constancy. In this two routes are followed. The first places emphasis on the requirement that but little heat is produced in the entire functional unit. The second requires that the nevertheless unavoidable heat shall be removed as rapidly as possible before it can have any effect upon the sledge components and supporting structure components which are subject to possible damage as a result of shifted position.

These measures start with the selection of the proper spindle bearings. For this one employs permanently lubricated radial-oblique ball bearings. Intensive heat sources in the form of electromagnetically switched couplings and brakes are avoided.

Hydraulically actuated linear gear-tooth couplings link the two transmission ranges with the lower rpm range being transmitted via a spur gear stage and the upper via a toothed belt drive. Thus there results a low number of heat-generating bearings, i.e., meshing gears or belts.

An intensive oil circulation serves to eliminate the resulting heat. Fresh oil first bathes the bearings of the main spindle and then runs over the walls of the housing, the meshing gears and the bearings. The former possess a white reflective coating of lacquer so that the heat is not absorbed but is radiated off into the cooling oil (thermos bottle effect).

Guiding Devices and Path-Measuring Principle Perform Important Tasks

The requirement of high workpiece accuracy is met moreover by the design of the guiding devices and the choice of the path-measuring principle employed. The guiding devices have in addition the task of providing good damping of an efficient cutting process in which a turning moment of 500 Nm can be transformed into cutting forces. They are therefore designed as a combination of sliding and rolling guides. The applied forces are reacted by stick-slip-free cast plastic guides coupled with steel or gray cast iron. The narrow guides and the directional guides are gripped with zero-play by peripheral roller elements running on hardened steel strips.

The path measurement is accomplished by means of induction coils which are placed immediately adjacent to the directional guides and which are thus little influenced by tilting.

For operation requiring little operating personnel it is of essential importance that in addition to securing thermal stability and eliminating process debris one should have automatic surveillance of the tools. Especially exposed to process damage are the slender tools such as thin spiral borers, countersinkers, thread borers, centering borers and the like. Before being used in cutting they can be checked by means of an electronic camera which observes the contour of the tool against an illuminated background and compares it with a target value. In addition to this recognition of severe fractures, a surveillance system assures that tool replacement is accomplished promptly before there is excessive wear. The corresponding signal appears on the pictures screen. A further step toward automatic low-personnel operation is represented by the possibility of measuring and appropriately evaluating by means of a replaceable measurement pickup chucking attitudes, oversizes, position errors, consequences of wear and other deviations from programmed initial states, intermediate states and final states of the workpieces.

For example, there was developed a subprogram for determining and correcting the position of the palettes or of the workpiece relative to the center of rotation of the fourth NC axis as well as to determine the angular rotational error of the latter with reference to the translatory machine coordinate system. By means of a double probing, taking place at a specific interval, over a reference area lying in the Z direction the obliquity of position is determined and thereupon within the guidance system the requisite rotational correction angle of the A axis is calculated and executed (Figure 7).

The determination of the displacement which manifests itself as an ecccentricity relative to the center of rotation of the axis is accomplished by lateral probing of the test piece (left and right), a subsequent 180° rotation and a repeated probing of one lateral surface whose position has been changed by the rotation.

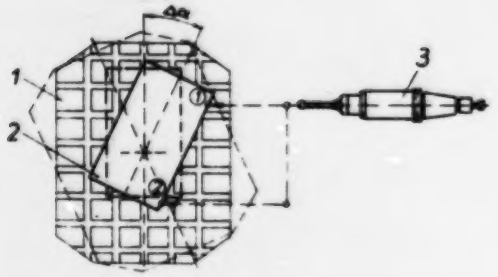

Figure 7. Position determination and position correction of obliquely chucked workpieces by means of measuring probes: 1--palette; 2--workpieces; 3--measuring probes; ①, ②--probe points in sequence; Δα--amount of correction (rotational).

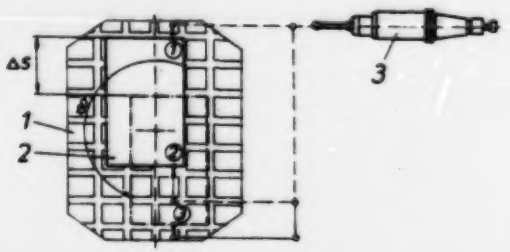

Figure 8. Position determination and position correction by means of measuring probes of workpieces chucked in a position which is displaced relative to the center of rotation: 1--palette; 2--workpieces; 3--measuring probes; ①, ②, ③--probe points in sequence; ΔS--amount of correction (translatory).

By means of these three measurement points the eccentric position is determined and stored and is taken into account automatically in processing two sides (Figure 8).

Naturally, it is possible in this way to make measurements only with that degree of accuracy which is permitted by the no-load accuracy of the machine and by the error of the measuring probe. Since, however, the positioning accuracy lies within a 10-μm range, the rechucking accuracy within 5 μm and the probing accuracy likewise lies within 5 μm it is thus possible to carry out a series of measurement operations with satisfactory results. In this way arbitrary measurement operations may be interpolated into the work cycle. At specifically limited time intervals, for example, it is possible to determine the thermal drift of the zero point of the workpiece position relative to the guidance coordinate system and it is possible for this to be corrected so that the stability of the workpiece quality can be guaranteed while maintaining a low level of human supervision. In a similar way dimensional deviations, excessive dimensions or chucking errors may be determined and corrected without the intervention of an operator.

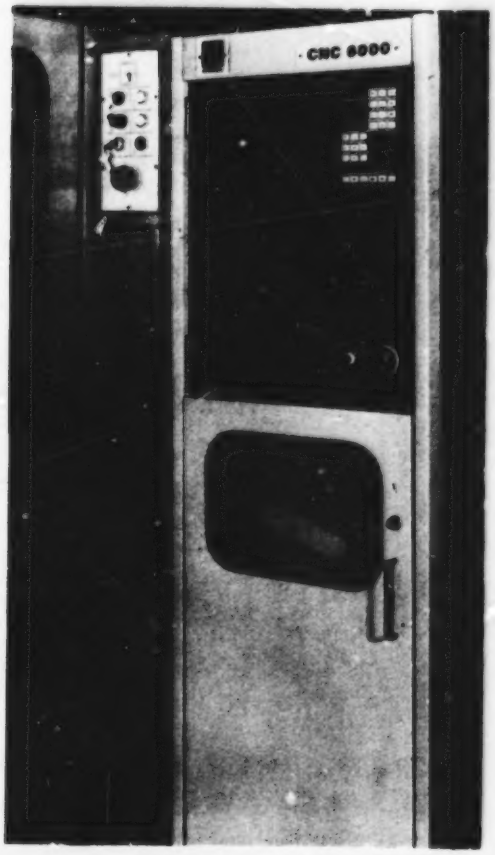

Figure 9. Computer-guidance CNC 6000 (Numerik "Karl Marx," Karl-Marx City/ GDR).

Guidance Using Specific Software Adaptation

For the new type of flexible manufacturing cell the guidance system CNC 6000 (Figure 9) is employed which in particular permits a specific adaptation of the software to the existing possibilities. The system permits path processings by 2D-circular, 2.5D-helical and 3D-straight line interpolation. Further characteristic features are:

i. convenient operation via an alphanumeric keyboard and picture screen display in conjunction with extensive editing possibilities and the output of an optimized program by means of an attachable punched tape perforator;

ii. extremely simple programmability in conjunction with an extensive subprogram technique involving 99 possible programs, capable of fourfold subnesting, containing in addition to frequently recurring process-specific processing cycles and machine-specific cycles (such as tool and workpiece changing) a series of geometric computing programs for the determination and fixing of the

workpiece contour. Equidistant correction makes possible in principle the workpiece contour programming as well as the dimension programming in circular milling and axis reflection;

iii. correction possibilities for measurement system errors (99 per axis) and reversal chucking (3 values per axis).

The guidance system processes the analogous signal inputs of the thermal sensors of the surveillance system of the supporting carriage, of the work spindles, of the workspace of the tools and of the stationary times. It carries out continuous self-diagnosis and reports any occurring troubles through error displays on the picture screen.

The measurement points recorded by the measuring probe and telemetrically transferred to the guidance system are processed via subprograms into diagnoses of the workpiece attitude and of the working accuracy.

Usefulness of the Facility Can Be Extremely High

In the test runs turning moments of 500 Nm were applied using knife-head milling tools of steel having a tensile strength of 500 N/mm^2. In such a case it was possible to mill with a cutting depth of 10 mm, a cutting breadth of 130 mm and a tool advance rate of 200 mm/min a cutting volume of 260 cm^3/min.

From the optimized adaptation of the guidance to the machine it was possible to extract considerable reserves of productivity. An example of this is the automatic tool advance calculation as a function of dimension in the milling of outside corners. While in the case of guidance systems of the older generation the corner, as shown on the left side of Figure 10, was produced by cutting straight path segments, in this design the corner is not milled simply by moving over a quarter circle but is produced at a higher optimal tool advance velocity corresponding to the size of the material to be removed (Figure 10, right). By this procedure alone it was possible to reduce the processing time for the sample workpiece by 12 percent.

Further substantial increases in productivity result from minimization of the auxiliary time. Features contributing especially to this are:

i. the free fall of the metal shavings from the cutting site into the automatic transport facility supported by the intensive programmable process lubrication and process cooling which take place in two pressure stages;

ii. the automatic in-process measurement technique which triggers immediately required corrections or displays them;

iii. the convenient operation including possibilities for program optimization with image screen support made possible by means of the new CNC 6000;

iv. the thermal control and diagnostics for stable maintenance of precision;

v. the possibilities for self-diagnosis in the guidance system.

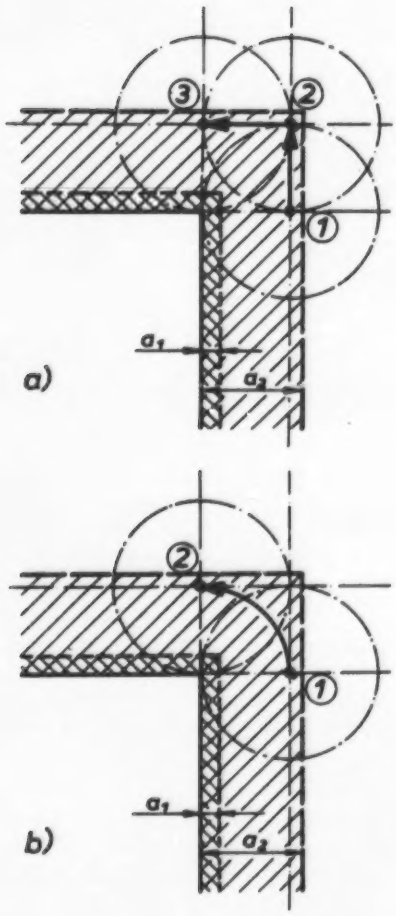

Figure 10. The use of path guidance in milling right-angled or oblique-angled cornerpoints: on the left--the original state (path guidance); on the right--the new state (with corner augmentation of forward advance); ①, ②, ③--point sequence of the tool path; a_1, a_2--milling breadths.

It is expected that as a result of the total of all these measures it will be possible to achieve an annual time saving in productive readiness amounting to at least 400 hours.

8008
CSO: 2302/3

RAPID DEVELOPMENT OF MICROELECTRONICS INDUSTRY DEFENDED

Budapest HETI VILAGGAZDASAG in Hungarian No 31, 31 Jul 82 pp 50-51

[Interview with Bence Adorjan, CSc, retired deputy director of the National Technical Development Commission's Institue for the Coordination of Computer Technology, by HETI VILAGGAZDASAG reporter Gizella Tarnoi]

[Text] The world regarded as a sensation a report entitled "Microelectronics and Society--A Matter of Life and Death" and prepared by the Club of Rome that comprises about 100 scientists of world renown. The study was reviewed as a series in HETI VILAGGAZDASAG. Parallel with this study there appeared in the spring of this year a Hungarian analysis of the social impacts of the development of microelectronics, which raises the same issues and arrives at more or less the same conclusions as the scientists of the Club of Rome. The author of "A Szamitastechnika Valaszuton" (Computer Technology at the Crossroads) is Bence Adorjan, age 61, a science candidate, retired deputy director of the OMFB [National Technical Development Commission] Institute for the Coordination of Computer Technology (Szamitastechnikai Koordinacios Intezet). We interviewed the author about his book.

HETI VILAGGAZDASAG: In the Hungarian economy the microelectronics industry is not dictating a dangerous speed, and therefore its social impacts are not frightening for the time being. Why are you nevertheless so concerned with this problem that you have systhematized your thoughts in book form?

Adorjan: I think it is very important to assess everything possible in advance, so that we will not be unprepared and will have time to consider what our most sensible course of action will be in the future. Although very many gifted persons are being born in Hungary, we are not utilizing adequately the possibilities inherent in the human intellect. Yet we have long been aware that we are not a country of iron and steel and must therefore seek the key to our success in our intellectual resources, not in our natural conditions. We must assess in advance what fields will border on microelectronics and encourage the training of specialists, or actually train them, accordingly. We must make computers, or at least calculators, available to as many children as possible, so that the computer literacy of the younger generation may increase in these contiguous fields.

HETI VILAGGAZDASAG: A blessing or curse, evolution or revolution, life or death--these are the questions asked by the scientists of the Club of Rome. In your opinion, are these questions timely also for us, and do they arise in the same manner as in Western countries?

Adorjan: They are indeed very timely in my opinion, but with the opposite sign. While the developed capitalist countries fear that the development of microelectronics will further increase the army of the unemployed and that the best workers in occupations that are still well-established today will find themselves on the street, we fear that we will not succeed in making every competent official duly aware that it would be a mortal sin to neglect the development of microelectronics. It is obvious that in every field, ranging from medical instruments through computers to the production of motor vehicles, we can be successful only if we rapidly apply the latest achievements in science and technology.

HETI VILAGGAZDASAG: In the richer capitalist countries microelectronics has penetrated not only material production but numerous areas of everyday life as well. Where can a Hungarian encounter this all-transforming technology in his everyday life?

Adorjan: Everywhere, if he goes about with open eyes. Microelectronics today plays an important role not only in production; it is penetrating increasingly into nonproductive services and even into households. Consider the latest programmable washing machines, or an integrated-circuit television set. These are the most simple examples, and even more complicated ones are within attainable reach. Imagine what the social impact will be if the television-based Teletext or Viewdata system spreads. With the help of his already existing telephone and television set, plus a minimum of additional hardware, a subscriber will be able to use in his own home the most diverse computer services. This will not only include entertainment and information services, but will also permit working at home in a variety of jobs. This form of microelectronics application is significant not only because less investment will be required in workplaces and also the time and expense of commuting can be saved, but also because working at home can set an example in family life and in the education of children in particular, and these are already social impacts.

HETI VILAGGAZDASAG: From what you say it appears that you regard all this as available in the immediate future. But to me it sounds utopistic. For example, I do not even have a telephone at home, and not because I have not applied for one.

Adorjan: Well, yes. Today a telephone is still a problem in many families. But the subscriber who has both a telephone and a television set will sooner or later be able to contact, at minimal additional cost, a central data bank of the kind that is being tested experimentally also in Hungary. I could go on listing examples of the applications in the developed countries where the Teletext or Viewdata system has already been introduced, and other future applications of such systems are perhaps unlimited. But one thing is certain: one of the most important results of the process of the development of electronics will be the same in Hungary as the one already perceptible in the industrially developed capitalist countries. What I have in mind is that people will have to become accustomed to the fact that they will have to change their occupa-

tions during their lifetime, perhaps even more than once, and that they will have to study continuously. The era of our grandfathers, when an occupation passed on from father to son, is long past. Through the applications of microelectronics, every customary machine and technology could change practically overnight.

HETI VILAGGAZDASAG: I read in a study that at least 40 percent of all office work can be automated. This figure alone indicates that millions could be forced to quit their jobs, as a result of which their present way of life could change. How can a society survive such a profound transformation?

Adorjan: I think it is very essential that computerization and electronics applications proceed in accordance with a state policy, for the very reason that reminded you of this example first of all. In my opinion, electronics should be introduced primarily were man has to work in an environment that is dangerous or injurious to health, and where raw materials and energy can be saved. Today we already have manpower shortages in many areas. To remain with the examples cited in your question, I do not believe that the surplus manpower replaced by the automation of office work will flow to occupations in which there are manpower shortages. To cite merely one example: the shortage of freight handlers at railroad freight yards is an enormous problem. But how many of the former office workers replaced by mechanization would be willing to load freight at railroad freight yards? In my opinion, not one. However, there are many branches of production--for example, the production of medical instruments or the engineering industry--were computerization would be of basic importance. If in these areas we could quickly apply the advances in microelectronics, we would also be able to alleviate our economic problems. However, this presupposes that we use electronics not because it is fashionable, but to satisfy actual needs.

HETI VILAGGAZDASAG: There has been mention of Hungarian microelectronics only recently. Mostly since December of 1981, when the Council of Ministers approved the electronic components program, allocated 4.5 billion forints for its realization, and decided to establish a Microelectronics Enterprise (Mikroelektronikai Vallalat). Is this sum sufficient?

Adorjan: I believe that spending on electronics is not keeping pace even with the already modest growth of national income. Stated differently: although national income is not growing as fast as previously, spending on electronics is not keeping pace even with this slower growth rate. Yet the widescale application of electronics could "pull up" the other branches of industry. The installed electronics equipment could make our machine tools and instruments more valuable, but they could also increase our results in agriculture, transport and education.

HETI VILAGGAZDASAG: The governments of the developed capitalist countries are supporting microelectronics with billions of dollars. But perhaps we do not even have to go West to obtain data for comparisons. Czechoslovakia, Bulgaria and the GDR are each spending the equivalent of 40 to 60 billion forints for the development of microelectronics. If we compare to this our 4.5 billion forint allocation, it is hard to believe that we will be able to overcome our lag within the foreseeable future.

Adorjan: Originally more was to have been earmarked for this program than the amount actually approved. The base shrank because the national economy's ability to finance such programs has diminished in recent years. For this very reason the available amount will have to be spent that much more prudently, and we must also try to have it increased if possible.

1014
CSO: 2502/87

BRIEFS

URANIUM MINERALS DISCOVERY--In the Nowa Ruda region, a small increase in the uranium content of the Glinik bed floor has been recorded; on the other hand, the main uranium-bearing horizon is found in the middle part of the Glinik beds in contrast to the Grzmiaca region and the area situated northwest of it, in which the uranium mineralization points occur in the roof of the Glinik beds. In the Stephanian, the uranium mineralization points occur in various parts of the Ludwikowice beds. Uranium minerals in the Glinik and Ludwikowice beds in Nowa Ruda are indicated by uranium oxides--uranium black--and secondary uranium minerals from the sulphate group--zippeite and uranopilite. Mineral paragenesis--uranium black, pyrite, chalcopyrite, sphalerite and galena--in mineralized uranium-bearing horizons of the Glinik beds in the Nowa Ruda region indicates an analogy with the uranium-bearing formations in the Grzmiaca region. [Excerpt] [Warsaw KWARTALNIK GEOLOGICZNY in Polish No 2, Apr-Jun 82 pp 287-292]

CSO: 2602/24

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JPRS 81868

28 September 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 755

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RESEARCH ACTIVITIES, ACHIEVEMENTS IN MOLECULAR BIOLOGY

Sofia VECHERNI NOVINI in Bulgarian 14 Aug 82 p 4

> [Text] Molecular biology and molecular genetics occupy leading places in the development of world science. This fact is determined by two main causes. The first is that these sciences reveal the most profound nature of living matter. The second cause is that they create the foundation of modern biotechnology. This is an especially promising branch of industry which, many experts believe, will fundamentally change modern economy.

These were the words with which we began our conversation with the professor and Doctor of Biological Sciences, Asen A. Khadzhiolov. This general statement is only a transition to the topic which was the reason for our meeting. Bulgarian biological science is not alien to the world problems and great achievements which characterize the revolutionary advance of modern biology. The center of these developments in our country is the Institute for Molecular Biology at the BAN [Bulgarian Academy of Sciences]. I asked Professor Khadzhiolov, deputy director of the institute, to outline the main problems which are being explored, since they constitute the basis of the Bulgarian participation in molecular biology and molecular genetics.

"Molecular biology is a leader among the modern natural sciences. As we all know, this was explicitly mentioned in the resolutions of the 12th BCP Congress. The great role and responsiblity of the Institute for Molecular Biology ensue from these resolutions.

"Of course, our institute cannot work on all problems. The goal is to focus our efforts on key problems and themes which we should study at the level of modern science. The organization, structure and functions of the chromatin, which is related to heredity in higher organisms, is being studied. We are working on the problem of the structure of deoxyribonucleic acid (DNA). In higher organisms it is built in a special way, still unclear to science. The genes, which are built by DNA, are linked with great areas of DNA whose structure is still unknown. The discovery of this structure will be of considerable importance for knowledge of the hereditary mechanism. Another problem which is being intensively developed is the mechanism of work of the separate genes in the cell, and especially the mechanism of ribosome forming.

They are immediately engaged in the work of all genes in the cell. In connection with this problem, we pay special attention to the possibility of isolating individual genes (from higher animals and humans) and their transfer into bacterial cells where they could produce the respective protein. We have implemented the basic methods and now we can isolate individual genes and transfer them into bacterial cells.

"On the basis of these theoretical studies, our institute is working on a directed synthesis of analogs of amino acids and nucleic acids, which have a healing effect in certain diseases."

Fundamental research work gives contributions with important theoretical significance. Please, mention some such achievements of the institute.

"I will limit myself to some scientific achievements more comprehensible to the layman and will try to present them in a simpler form. Important results on the structure of chromatin were achieved by the team led by Academician Rumen Tsanev. Some basic properties of the nucleosome organization of the chromatin and the process of the very building of nucleosomes were discovered, as well as the importance of individual histone and nonhistone proteins in the replication of chromatin. The research reveals the mechanism of cell division. And these mechanisms are related to such important processes as the normal and the pathological growth of the cells, which can be observed, for example, in tumor tissues.

"Other, even more interesting, scientific achievements are related to the development of methods for transformation of microorganisms, i.e., transport of genes into microorganisms. This has been achieved with the genes for enteroxins of the intestinal bacterium and the genes for ribosome ribonucleic acids of higher organisms.

"Considerable results were achieved in the research of the structure and expression of the genes. An original method was developed which makes it possible to single out only those genes, from the great number of genes in the cell, which are functional in a given moment of our life, i.e., the active genes. We expect that through this method we will discover possibilities for control of the switching on and off of the genes in different normal and pathological processes.

"The research of the action mechanism of the analogues of nucleic acids, which we have synthesized, revealed considerable regularities which gives the possibility for intervention in the metabolism of the cells.

"Another large area of application of the scientific achievements is their practical usage. In this way, they are realized as factors with immediate importance for the advance of separate branches and, in the final score, they are a contribution to the total development of the economy in our country.

"We have reasons to believe that modern biotechnology in our country will develop even faster in the coming future. That is why our applied projects are aimed at solving problems mainly in this area. Based on methods of genetic engineering, original approaches are being developed in our institute for

the creation of some biologically active substances. One of them is the interferon, which has a strong curative effect in virus infections. We are also developing technologies for the use of mutation enzymes produced by us as nutritional protein. Some compounds synthesized in the institute showed strong antitumor effects and are currently in the process of experimental and clinical testing.

"With its theoretical and applied studies, the Institute for molecular biology makes and will continue to make its contribution for the implementation of the biologization as a main factor in the development of the country's economy."

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SM 52/11 COMPUTER SYSTEM, SMEP II PROGRAM DESCRIBED

Prague VYBER INFORMACE Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 2, 82 pp 159-166

[Article by Vladimir Hanus: "Systems of SMEP Series II"]

[Text] The low cost, cheapness of operation and power of the highly competitive series of medium-sized computers and their wide, easy adaptability to specific requirements, which brings computers closer to the use, are the main advantages of mini- and microcomputers. The benefits of incorporating them result to a considerable degree from their software. The operating systems of mini- and microcomputers are much simpler than large operating systems, are primarily interactive, and guide the user to correct formulation of his requirements. The use of a large number of display terminals allows operation in the dialog mode and makes it possible to limit hard copy to essential needs, in addition to bringing about direct contact between the user and the computer. Most of the service work is conducted by the operating system. Compatibility with systems higher in the hierarchy in both on-line and off-line operation results from the choice of a transmission channel or a suitable medium, while inefficient intermediate steps (e.g., the old-fashioned punching [on tape or cards] of raw data or data conversion) can be entirely eliminated. This list of advantages applies to products developed under the SMEP II program here in Czechoslovakia. In comparison with the systems delivered under the designation SMEP I, the new systems make more use of the advantages offered by microcomputers, in addition to which the minicomputers which previously were the nucleus of the SMEP system have been substantially modernized.

The production program for SMEP series II, whose products will meet user demand this year and in succeeding years, currently consists of four basic types:

System	Characteristics	Equivalent	Year
SM 52/11	Minicomputer with most powerful SMEP processor	PDP-11/60	1983
SM 50/40	8-bit microcomputer	Intel 8080A	1982
SM 50/50	16-bit microcomputer	LSI II, AM2901	1983
SM 53/10	Distributed multicomputer system based on SM 50/40 or 50/50		1984

In addition to these systems, a video graphics-processor with a memory-equipped display unit based on the Intel 3000, designated the SM 54/30, is in the production-preparation stage. The SMEP series I systems, which are now in extensive use, will be replaced in the future by series II. The production of the SM 3-20 is to be terminated in 1984 and that of the SM 4-20 in 1985-1986; their replacement, particularly in the ASR TP [Automated System of Technological process control] area, will be extremely simple and beneficial. In the ASRP [enterprise automated management system] field, when very simple applications such as simple data collection are not involved, the SM 52/11 is currently the most suitable replacement for the SMEP I series, and more attention should be devoted to it.

The SM 52/11 16-Bit Minicomputer

Designed for real-time, time-sharing operation, this system is upwardly design-, system- and program-compatible with the SM 3-20 and the SM 4-20. Its basic configuration consists of:

--the SM 1403 processor,

--a 128 KByte self-correcting NMOS semiconductor main store (64K-word module),

--a simple time clock,

--a disk-pack store controller,

--a double disk-pack store (2 x 2.5 MByte),

--a display,

--a matrix printer,

--a processor frame,

--a power-supply frame,

--a rack,

--a programmer's console.

The SM 1403 Processor

This processor consists of an ALU [Arithmetic and Logic Unit] and control unit with the SMEP instruction set, an internal expanded instruction set and instructions for floating-point arithmetic, the memory organizer and programmable stack allocation, cache memory, a programmer's console and circuitry for system functions such as instruction decoding, priority levels and interrupt, interface with the common bus, error control, and automatic restart after loss of power.

The ALU [microprogram type) allows the use of 132 instructions, including instructions for multiplication, division, 32-bit and 64-bit arithmetic, floating-point arithmetic and user-microprogrammed and service instructions. The main instruction set is intended for basic applications and is identical with that of the SM 3-20. The expanded instruction set, compatible with the

SM 4-20, controls fixed-point arithmetic operations and multiple shifts or cycles. The internal floating-point processor [FPP], compatible with the SM 4-20, operates sequentially in simple or double-precision arithmetic.

The memory organizer (identical with that in the SM 4-20) is responsible for memory protection and program relocatability and allows addressable memory to be expanded from 56 KByte to 248 KByte. The virtual address area has 16-bit addresses, while the physical area has 8-bit addresses. Programmable stack allocation allows operation with hardware memory allocation, which simplifies processing of data structures, subroutines and interrupts. The minimum stack address is 400, the same as in the SM 3-20 and SM 4-20. It can extend as high as an upper boundary of 32K words in 200-word increments (400 bytes).

The cache memory accelerates processor access to stored data and instructions. The cycle takes less than 550 microseconds. The preselected section of main memory copied may be as large as 2,080 bytes. In addition to its speed, another advantage is its limitation of the use of the common bus, which creates room for transmissions between I/O [input/output] devices and storage. The programmer's console, part of the permanent equipment supplied with the processor, simplifies the work of both the operator and the technician. It allows operations with the processor registers and all memory cells in main storage. Standard functions allow direct initialization of the program of a loading module or the start of a selected diagnostic module.

The priority system has four levels, to each of which a relatively unlimited number of devices may be connected. Their priorities are determined by their physical locations: the closer to the processor, the higher the priority. The system uses a stack in which the processor stores the important program information in case of an interrupt, allowing automatic return to the same program location under the same conditions as before the interrupt.

The common bus interface, which allows communication between individual system components, is asynchronous, and accordingly is suited to use with devices of different speeds. The 4K words of memory allocated for I/O can be expanded to up to 32K words for special uses.

The nucleus of the error-detection system is the set of registers. In case of an error, the information stored in these registers allows it to be rapidly located and analyzed. If an error occurs in cache memory, the optional FPP (see below) or the user-accessible control store, these modules can be disconnected. The system can continue operating, although with a limited instruction execution speed. The power loss protection feature is put into operation by a processor vector if the line voltage drops below 190 volts. Program execution is suspended and the power-loss program stores the data contained in the registers, as well as the state of the peripheral devices. When the power is restored, an interrupt vector is used to start the power-on program and restores the status of the system before the loss of power. In some extreme cases a load module may be used.

The basic processor can be expanded with the following optional modules:

--An external FPP which operates asynchronously with the main processor, to whose internal bus it is connected. When it is connected, the internal FPP is disconnected. Arithmetic operations are performed in parallel at high speed, which greatly increases the power of the system in processing floating-point instructions. This is particularly suitable for use in complex scientific and technical computations.

--The user-accessible control storage, an expansion of the processor's control memory; only one of three possible variants can be installed:

--a. The RAM-type user-accessible control memory with suitable software, designated WCS, has a capacity of 1,024 microwords and is used to create and debug user programs. The width of the control word is 48 bits plus 3 parity bits, while a data work consists of 16 bits plus 1 parity bit. Odd parity initiates a check.

--b. The PROM-type expanded control storage, designated ECS, has a maximum capacity of 1.5 K and a control word length of 48 bits, and can be used to store user microprograms.

--c. The ROM-type diagnostic control memory, designated DCM, with a maximum capacity of 2K words and a control-word length of 55 bits, is used for micro-program testing of the main processor and error location in a given module and its integrated circuits in the DCS itself.

All accessories usable with the SM 2301 and SM 2401 (SM 3-20 and SM 4-20) can be used with the SM 1403 processor. All programs developed for the SM 3-20 and SM 4-20 can be used with it.

Basic Parameters of the SM 52/11

Maximum usable main storage	124K words
Size of cache store	1K words
Total numbers of registers	92
Total number of ALU registers	80
Instructions	139
Number of interrupt levels	4
Byte	8 bits
Word	16 bits
Optional I/O page	4K-32K words
Standard I/O page	4K words
Register-register operation time through cache memory	0.34 microseconds

Comparison of time required for accumulator-accumulator operation using cache memory and floating point operation with internal and external FPP (micro-seconds):

Item	Internal FPP	External FPP
ADD	4.8-110	0.68
MULD	200-238	3.06
DIVD	240	12.41

NMOS Main Store

This is a self-correcting semiconductor store with a capacity of 28 Kbyte with a 64K word module. It can be expanded to twice the capacity, i.e., to 128K words. Within the SMEP configuration it is designated SM 3511. This memory detects all double errors and some multiple errors and automatically corrects all simple errors. Within the 128K-word capacity, access to subsequent words may be blocked. The modularity is 16K words, and the word length 22 bits, including 6 control bits.

Common Bus

This bus allows connection of individual system components and communication between them. A unified communications method is used: for example, the processor uses the same set of signals for communication with storage as does the peripheral equipment; the same is true of communications between peripherals and the processor, and so on. Communication along the common bus is asynchronous and works in the handshake mode. The devices connected to the bus have different priorities, and subordinate devices must always yield to superior devices.

Within the SM 52/11 system the following external storage and I/O support modules may be used:

--A simple time clock is an optional expansion module which, in combination with the processor, is used for generating interrupts at 200-millisecond intervals.

--The SM 2001 programmable time closk is an optional expansion module which, in combination with the processor, generates precision time intervals, measures time intervals and generates pulse trains.

--The SM 5105.7 disk-pack-store controller allows 1 to 4 SM 5400 or SM 5403 disk stores with a capacity of 2 x 2.5 Mbyte to be connected to the system.

--The SM 5001 magnetic tape store controller allows 1 to 4 SM 5300 (capacity 100 Mbyte) or SM 5302 (capacity 200 Mbyte) magnetic tape drives to be connected.

--The SM 5605 floppy disk external store includes a controller and power supply and two 512 Kbyte disk drives.

--The P80-8 parallel adapter, SM 6001, allows a tape reader-punch, keyboard, matrix printer, line printers or displays to be connected to the system if

they have access to an 8-bit IRPR interface. Transmission is asynchronous and the maximum speed is 300K b/sec.

--The PAD-12 parallel adapter (no SM designation as yet) allows card readers to be connected with the system if they have access to the IRPR 12-bit interface.

--The PAD-16 parallel adapter (no SM designation as yet) allows accessory 16-bit equipment such as the Digigraf drawing table, the Digibak-5T or a digitizer to be connected to the system. The maximum asynchronous transmission speed is 300K b/sec.

--The ASAD asynchronous serial adapter, SM 6002, allows transmission equipment to be connected to the IRPS interface (universal current loop) or the S2 interface (CCITT recommendation V.24). The maximum transmission speed is 9600 bits/sec.

--The quadruple SAD, QASAD, SM 8512, allows connection of up to four transmission devices having IRPS or S2 interfaces. The maximum transmission speed is 19,200 bits/sec.

--The SAD synchronous adapter, SM 8506, allows devices using serial asynchronous transmission to be connected to the common bus or the system to be connected into a computer network.

--The AMU (AMUX) asynchronous multiplexor, SM 8511, allows up to 8 (or 16 with expansion) serial asynchronous transmission devices to be connected to the common bus if they have the IRPS or S2 interface.

--The MDS 200 modem (no SM designation as yet) allows asynchronous transmission at a speed of 200 baud. It is suitable for connecting matrix printers with the SM 7108.7 keyboard.

--The MDS 1200 modem (no SM designation as yet) allows remote connection of video terminals and connection of SMEP minicomputers into the network. The maximum transmission speed is 1,200 baud, or 75 baud in a backward channel.

--The SM 8105 null modem allows local connection of terminals with S2 interface to the SASD or AMU; it replaces standard modems.

--The SM 6208 tape reader-punch contains control electronics for access to the IRPR interface, allowing input at a maximum speed of 300 characters per second and output at a maximum speed of 50 characters per second, using 8-track paper tape.

--The EC 6112 card reader allows entry of data from punched cards with a maximum speed of 200 cards per minute; it is connected to the PAD-12.

--The SM 7601 input keyboard allows entry of alphanumeric data into the IRPR interface through the PAD-8.

--The SM 6303 matrix printer for serial output of alphanumeric data is furnished in several modifications. It is connected through the PAD-8.

--The SM 7108 matrix printer and keyboard unit for input and output of alphanumeric data has a maximum printing speed of 30 characters per second in a 132-character line. It is connected through the PAD-8. The model designated SM 7108.7 allows remote interfacing and is connected through an ASAD (IRPS) or through an ASAD and modem.

--The SM 6313 line printer allows output of alphanumeric data at a speed of 660 lines of 136 characters per minute. It is connected to the PAD-8.

--The SM 6315 line printer is a similar printer with a printing speed of 550 lines per minute.

--The SM 7202 alphanumeric display terminal with keyboard allows remote interfacing with the system and displays 1920 characters in 24 lines of 80 characters each. The data may be printed by connecting the SM 6303 output printer. It is connected through the PAD-8 or ASAD (IRPS and S2) or a suitable modem.

--The SM 1601 simple terminal display unit allows remote interfacing with the system and displays 1024 or 480 characters in a format of 64 x 16 or 40 x 12. It is connected through an ASAD or through an ASAD and modem.

--The SM 9402 numerical terminal allows remote entry of digital data (10 characters) with simultaneous display on a 14-digit field. This autonomous self-contained device has an IRPS or S2 interface and is connected to an ASAD or to an ASAD and modem.

--The SM 7404 vector graphic intelligent terminal allows a vector display on a 1024 x 1024 raster and is connected to the system via an IRPS or S2 interface. It contains the SM 2301 processor and a graphics processor, a graphic display with light pen, and a keyboard or display unit (SM 1601 or SM 7020). It operates under the DOS RV operating system.

--The planned SM 9101 external interface allows data connection in the continuous or intermittent mode from a process and its entry into the controlled process. It is designated the DASIO 600 and contains an internal control module, a converter, a commutator and the like, and input signal conditioning modules. It is connected to the system bus by an SM 9004 controller which has three alternate designs for different operating modes.

--The SM 0102 control unit for the IMS-2 allows control of the integrated control system and execution of the full set of commands for the IMS-2 functions.

--The SM 9205 laboratory process interface unit allows collection of analog signals from laboratory research apparatus and output of analog signals to a controlled process. Input is via an 8-channel multiplexor, an amplifier and a 12-bit analog-digital converter. An oscilloscope with memory functions or BAK-5T analog recorder can be used for output.

--The CAMAC [a European multiplex interface standard] rack control unit allows control of the minicomputer system rack with a common bus. It is designed as a module and is plugged into the control frame in the control-unit position. It is connected via a cable.

Software Resources

The software resources developed within the SMEP program are subject to no such memory capacity limitations as in the SM 3-20 when they are used in the SM 52/11 system. The available operating systems include:

--The FOBOS disk-operating system, two-program or one-program type for one user, intended for interactive program design in on-line applications. It allows operation in Macroassembler, Fortran IV, and Basic. When Basic is used, the system can service up to eight users through terminals; chain, laboratory or graphic peripherals can be used.

--The DOS RV2 high-speed system for an extremely wide range of applications in a dynamically changing environment. It provides memory protection, memory allocation, multiuser operation and user programs, overlay of program segments in memory, file protection and multiprogramming. It is suited for rapid effective installation and direct use at a high user-oriented level, but can also be used for tasks at a lower system level.

--The DIAMS disk-oriented system for creation of information systems and data bases in the dialog mode with multiple user access. This is a user-oriented multiprogramming time-sharing system. In the modernized version intended for the SM 52/11 it is capable of simultaneously serving more than 60 users and connection with up to 81 terminals.

--The TMOS operating system, intended solely for testing and diagnostic purposes; it allows a complete system testing.

Other available software resources include:

--the SYRPOS system for computer network control;

--the PPPD system for data preparation, preprocessing and transmission;

--a system for operating under the OS DOS RV2;

--a set of programs for scientific and technical computations;

--the SMGRAF set of programs for servicing graphic displays;

--program resources for user microprogramming;

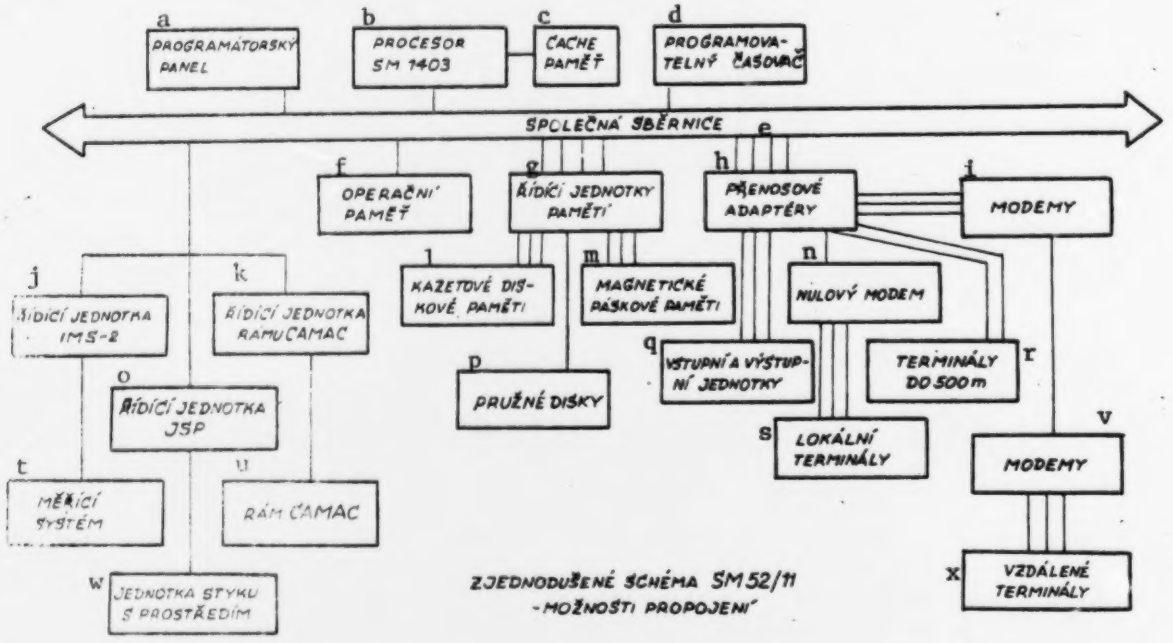
--the MICRO-52/11 assembler, operating under the DOS RV operating system;

--the MLD program loader for operation under the DOS RV operating system;

--the MDT loading program which operates independently, without an operating system.

Macroassembler, Fortran IV, Fortran IV-Plus, Basic Plus-2, Basic, COBOL and Microassembler can be used.

To conclude this brief survey we may state that the information presented was collected from the newest available documentation, which consists of articles and information from staff members of VUVT [Research Institute of Computer Technology] in Zilina, and of ZVT [Computer Equipment Plants] in Banska Bystrica. Possible refinements in the development of the SMEP II program made by ZAVT [Automation and Computer Plants] concern, and its subordinate management organs may result in changes in some of the data presented, but their effect would not be such as to fundamentally change the design or power of the system or invalidate conclusions and decisions by prospective users on the basis of the present information.



Simplified Block Diagram of SMEP 52/11: Possible Interconnections

Key:

a. Programmer's console
b. SM 1403 processor
c. Cache memory
d. Programmable time clock
e. Common bus
f. Main store
g. Storage unit controller
h. Transmission adapters
i. Modems
j. IMS-2 controller
k. CAMAC rack control unit
l. Disk pack store
m. Magnetic tape store
n. Null modem
o. JSP controller
p. Floppy disk units
q. I/O units

Key to Figure (Continued):

r. Terminals, up to 500 m
s. Local terminals
t. Measuring system
u. CAMAC rack
v. Modems
w. Process interface unit
x. Remote terminals

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SYNTHETIC PHEROMONES PROGRAM OUTLINED

Bratislava CHEMICAL REVIEW in English Apr 82 pp 23-24

[Article by Ing. Rudolf Bezak]

[Text]

Problems associated with the nutrition of mankind are the main cause of the adverse antropogeneous intersentions into living environment in the effort for maximum utilization of soil fund. The most adverse environmental impact are the result of the mass application of pesticides in the fight against plant pests. Another serious consequence of improper application of pesticides is the formation of a resistant population of pests as well as the side effect of these non-specifically functioning substances on useful insect and naturalenemies of harmful insect affecting thus the biological equilibrium in nature. One of the most serious consequences of the mass application of pesticides is the increased quantity of these substances in plant product endangering directly or indirectly the human health.

There is an increasing number of specialists and leading personalities of social systems who are engaged in the problems of the reduction of pesticides in plant protection.

One of the methods of reducing the pesticide consumption is the utilization of synthetic pheromones as the intra-species means of communication.

In the recent time special attention is paid to the communication substances of insect, particularly to the sexual pheromones, especially in harmful species. Knowledge of the basic research penetrates promptly into practice and in a number of developed countries extensive research projects aimed at the utilization of pheromones for mapping the occurrence of pests and controling chemical fight against the pests within the so called channelled or integrated plant protection are carried out.

The current programme of the studies on pheromones in the CSSR is focussed particularly on the utilization of pheromones for mapping the pest occurrence and controling the chemical protection although (especially in forestry) experiments are carried out concerning the utilization of pheromones as the means of direct pest control.

The basic research of the pheromone synthesis is carried out in the Institute of Organic Chemistry and Biochemistry of the Czechoslovak Academy of Sciences and the Entomological Institute of the Czechoslovak Academy of Sciences in Prague. At present, a laboratory preparation of two pheromones has been mastered one of which can be used for the signalization of the codling moth flight and the second for spruce bark beetle control.

The method of signalization of the male codling moth flight employing the pheromone traps is an important way for channelling the protection of the kernel fruit orchards against these pests.

Information obtained by means of pheromone traps can be used for a more precise determination of the target application of the pesticide. Focusing the chemical fight against major pests entails considerable savings when considering the number of sprayings as well as the volume of pesticides applied. This fact is of great importance not only from the economic point of view but also from the aspects of the living environment protection.

Practical application of pheromone traps — besides the large-scale production — can be successfully employed by private growers — gardeners — because of the simple attendance.

The selective method of the spruce bark beetle control by means of the pheromone traps is a very important means in the protection of spruce growths against this dangerous pest. When using the pheromone traps, the fight against the bark beetle becomes more intensive without using pesticides.

In case of the spruce bark beetle swarn the pheromone traps can be used successfuly used for selective catching and subsequent mechanical eradication.

The problems of prompt introduction of pheromone traps for the signalization of the codling moth flight and spruce bark beetle control to practice are solved by the following institutes: Institute of Organic Chemistry and Biochemistry of the Czechoslovak Academy of Sciences, Prague — it deals with laboratory synthesis and formulation of pheromones (basic research); Entomological Institute of the Czechoslovak Academy of Sciences in Prague —

dealing with the basic materials for the implementation of monitoring systems including materials for final approval; Research Institute of Inorganic Technology in Bratislava — dealing with application research, production and application of pheromones including their registration; Commercial Organization Chemika Bratislava — ensuring pheromone adjustment and planning to start also the production of required active substances as well as the production of pheromone auxiliaries including commercial activity.

Other institutions taking part in the solution of above problems are: Central Inspection and Testing Agricultural Institute, Prague, Central Inspection and Testing Agricultural Institute in Bratislava, Ministry of Agriculture and Nutrition of the CSR, Ministry of Agriculture and Nutrition of the SSR, Research Institute of Forestry and Hunting Strnady, Research Institute of Forestry Zvolen, Research and Breeding Institute of Fruits Holovousy and others.

To promote a permanent development and production of pheromones and their efficacious introduction to practice, materials are under preparation for formulating a state project oriented to continuously decreasing the use of pesticide. An original solution of the production of active substances might open possibilities for the export of the preparations for Pheromone tramps.

Successful development of these preparations will enable the CSSR and other countries of the socialist community to introduce more modern methods of plant protection meaningfull from the aspects of the living environment improvement, cost savings in the sphere of pest control and finally as an important antiimport measure.

CSO: 2020/57

RESEARCH, DEVELOPMENT OF PLANT PROTECTION PREPARATIONS

Bratislava CHEMICAL REVIEW in English Apr 82 pp 17-19

[Article by RNDr. Stefan Varkonda, CSc.]

[Text]

Research and development in the production of chemical agents for plant protection in the CSSR in the fifties and sixties considered especially the needs of the quickly developing socialist agricultural large-scale plant production. According to the results of the Research Institute of Agrochemical Technology in Bratislava which has become the leading institution of the scientific and technical development with inter-sectorial competence in the field of pesticides, more than 25 preparations were introduced into the production by the end of the 5th Five-Year Plan. Permanent re-evaluation of individual products from the aspect of ever demanding criteria typical for the this field, resulted in the fact that only about one firth from this assortment is manufactured today.

The urgent need for an insecticide against Colorado beetle and other pest control, herbicides for the wild oat control and a more universal type of fungicide was expected to be met by Decemtion EK-20, Fatex EK-50 and Novozir Mn-80. This programme was completed on the research basis already at the beginning of the seventies and is known as Agro II.

In the next period the research was dealing with the production of phenoxyherbicides MCPA and MCPP, triazine and some other herbicides including the necessary intermediates. This conception together with Agro II should ensure the key assortment of preparations for the protection of the most important crops. Import of preparations from non-socialist countries would be substantially reduced and at the same time conditions for the specialization of the CSSR and for its more active participation in the cooperation within the CMEA member countries would be established.

Agro II is to be implemented in Duslo Šaľa. After building up the production capacities the assortment of home preparations for plant protection will be enlarged by the above mentioned three preparations as well as by the original Czechoslovak systemic fungicide known as Fademorf EK-20.

Decemtion EK-20

Already in 1963 the first strains of Colorado beetle resistant against the preparations on the basis of chlorohydrocarbons were selected in Slovakia, too. Not even treatment improvements and additions of antiresistant agents did lead to satisfactory results. Therefore, the researches started to develop the technology of phosmet (O,O-dimethyl — S)phthalimidimetyl(dithiophosphate) and its final form known under the trade mark of Decemtion EK-20. It is an insecticide and acaricide with contact, fumigation and partly also in-depth effects. It was described for the first time in 1961 and started to be manufactured by the Stauffer Co. in 1966 under the trade mark of Imidan. The technology realized in Czechoslovakia enables to manufacture phosmet of 97—99 % purity.

The originally planned scope of application of Decemtion EK-20 was considerably extended. It is used with success not only in Colorado beetle control (including larvae) but also for blossom beetle control on rape, control of moth on fruit trees, slugworm and aphid control, for protection of vines, vegetables and ornamental plants. In several preparations it can replace the hitherto used Metation EK-50.

According to the WHO classification it ranks among substances with medium toxic effects. As it degrades easily and has less toxic effects on predators of mites, it might be applied in the selected systems of integrated plant protection. The preparation does not leave any undesirable residues in the living environment.

Fatex EK-50

Wild oat spread out in the CSSR to such an extent that at the end of sixties the control of this weed decreasing the yields became part of agrotechnique of growing some plants. However, all herbicides used for its control had to be imported — mostly from capitalist countries.

Therefore, The Research Institute of Agrochemical Technology has elaborated materials on the production and application of chlorophenpropmethyl (methyl ester of 3-(4-chlorophenyl)-2-chloropropionic acid). The final product containing 50 % of active substance is known under the trade

mark of Fatex EK-50. The technology enables to manufacture chlorophenprop-methyl of 96—97 % purity.

It is a specific herbicide with contact effects and therefore it is used for postemergence control of wild oat. The weed disappears 14 days after application. The preparation can be applied to barley, wheat and sugar beet showing a good tolerance to it when applied in recommended doses. When properly applied it does not leave any residues in the culture. According to WHO it is a preparation with low or even zero toxicity. It is expected that more than 100 000 hectares will be treated with this preparation every year.

Novozir Mn-80

Fungicides represent a very significant item in the import of plant protection preparations. Our assortment is represented only by preparations on the basis of copper and sulphur compounds. In the meantime a number of newer contact and systemic fungicides appeared in the market. The research programme of the Research Institute of Agrochemical Technology (VÚAgT) involves technology of the production of mankozeb (manganese-zinc ethylene bis-dithiocarbamide) which will known in the market under the trade mark of Novozir Mn-80.

This is a fungicide with protective effects and a wide spectrum of application. It is designed for protection of several cultures such as potatoes (even during storing), vrapevine, tobacco, wheat, roses and the like. The preparation will not only considerably reduce the costs for import of similar preparations but it can be applied to such treatments which have not been performed till now.

The technology proposed by VÚAgT enables to manufacture the preparation with a purity of 90—93 %. It is expected that the preparation manufactured will not contain high amounts of undesirable ethylene thiourea and will be applied also in such crops where its application was not envisaged because of hygienic and toxicologic reasons.

Fademorf EK-20

Among the most significant results of the Research Institute of Agrochemical Technology in the seventies is the discovery of fungicidal properties of N/1-phormamide-2, 2,2-trichloroethylmorpholine. Successful research on biological properties and the toxicologic studies provided a sufficient amount of material resulting in the decision to desing the technology for its production.

The active substance generally konwn as trimorphamide is applied as a 20 % emulsion concentrate known under the trade mark of Fademorf EK-20.

Availability of the preparation from the pilot-plant production enabled to carry out an extensive biological investigations also under climatic and soil conditions of other CMEA member countries. Due to this, the preparation has already been registered in the USSR and Romania and its registration in the GDR, Poland and Hungary is expected in the near future as well. This confirms also the expectations as for its eventual export.

The original Czechoslovak fungicide is effective for the control of powdery mildews of apple trees, grapevines, tobaco, cucumbers, goseberries, roses and also its aplication to barley protection is possible. This is a substance with systemic properties. After application it does not remain on the plants but penetrates into the tissues and through the vessel system it reaches also other parts and organs protecting thus the whole plant. It has not only protective effects but also curative ones. As for its acute toxicity the preparation is classified according to the WHO classification among substances with low toxicity. The active substance has not cumulative properties and is decomposed relatively quickly after its application.

According to the toxicologic research studying not only acute effects but also, mutagenic and carcinogenic effects, effects on warm blooded animals, etc. no unfavourable parameters were recorded.

Its production is scheduled to start in 1984 in Dusło Šaľa providing thus a product suitable not only for the Czechoslovak agriculture but also for eventual export.

The results of the current applied research of VÚAgT should be soon reflected in further improvement of the preparations on the basis of atrazine, MCPA and chloridazone. It concerns particularly improvement as for their application as well as reduction of their possible harmful effects on the living environment.

Research and subsequent realization are engaged with rationalization of the production of these preparations. Necessity of further development of research, development and production of plant protection agents is emphasized in the target outlined at the 15th and 16th Congresses of the Communist Party of Czechoslovakia concerning the increase of the self-sufficiency in the production of agricultural products. Chemical protection takes

here an important and hitherto unreplaceable position. With respect to lower investment possibilities further development of pesticides should be considered more comprehensively. Within the framework of Slovchémia a conception is being prepared which should establish conditions for increasing the export, for specialization and cooperation within the frame of socialist countries. The most important aspect is that of raw material supply which is important from the aspects of decision whether to adopt the variant of complete production from the beginning or the way of cooperation.

In the next years the applied research of VÚAgT should take up the outputs of basic research of the Czechoslovak Academy of Sciences and the Slovak Academy of Sciences as for the substances of new generation and some biopreparations. It is expected that the solution of production and application problems associated with the above mentioned preparations will result in a distinct increase of the level and economy of plant protection with significant positive impacts on the living environment protection, too. This aim corresponds to the world trends.

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PESTICIDE APPLICATION TRENDS

Bratislava CHEMICAL REVIEW in English Apr 82 pp 20-22

[Article by Ing. Frantisek Richter, CSc., Ing. Vaclav Peterka]

[Text]

In the period of the construction of a developed socialist society the Czechoslovak Socialist Republic has recorded a remarkable increase in food consumption — both of plant and animal origin.

On the basis of the programme of improving the living standard of the Czechoslovak population outlined by the 16th Congress of the Communist Party of Czechoslovakia, the main target of agriculture is to provide individual foodstuff articles and raw materials for their production while at the same time increasing the self-sufficiency. Increasing the production of foodstuffs through the domestic agricultural and foodstuff productions is a demanding target from the aspects of the application of available intensification elements — chemization, biologization, mechanization and the like. The agricultural production is intensified through gradual increases in the doses of industrial fertilizers per hectare of agricultural land in the whole country, introduction of high-productivity species of agricultural crops, improvement of pest control and protection against plant diseases, application of available preparations for weed control, improved cultivation of land, etc.

During the last thirty years the application of industrial fertilizers in the CSSR increased considerably. In 1980 as many as 255 kg of the NPK pure nutrients (nitrogen-phosphorus-potassium) were applied per hectare of agricultural land. Recently, a substantial improvement of soil reaction was achieved by liming even soils which were classified as strongly acid and thus, conditions for further improvement of fertilization were created.

Higher intensity of plant nutrition results usually in a higher fertility of individual plants, higher quantity of aboveground mass, but this provides also a better food basis for pests and diseases. The growth of harmful agents is also a function of the climate. Higher doses of nutrients (NPK) promote also the growth and development of weeds.

Chemization of the plant production is one of the most serious intensification factors in agriculture and has a significant share in the increase of yield per hectare. An important aspect of chemization in plant production is the chemical plant protection against pests, diseases and weeds, desiccation of the plant mass prior to the harvest of seed products, application of growth factors as well as other activities affecting the hectare yields.

The main task in the plant protection — besides the prevention of harmful agents — is the direct fight against diseases, pests, easily and less easily controllable weeds as well as chemical treatment to prevent lodging of cereals, and utilization of desiccation for drying prior to the harvest.

Plant protection against harmful agents is extending. In the CSSR the plant protection was extented particularly in the process of specialization and concentration of agricultural large-scale production. Under the present conditions it involves a very wide and demanding scope of activities. The current plant protection enables to reduce losses in the yields of individual treated crops and prevents the losses during the storing of crops and plant products. Chemical weed control and elimination of harmfull effects on crops enable to mechanize and rationalize the harvest and to apply the most modern large-scale technologies. Thus, also a better return of basic investments into the soil is ensured, such as the adjustment of water regimes of soils, genetic potential of soil, adjustment of soil reaction and other reclaiming activities.

Plant protection has become one of the basis factors which is decisive for the level and stability of agricultural production. Investments in the sphere of plant protection affect material costs as well as the final effect of the plant production. It has an operative character in the Czechoslovak natural conditions as very year has its specific characteristics with respect to the occurence of individual harmful agents.

Plant protection preparations — pesticides — have bocome part of large-scale technologies. The development of new pesticides during the last 25 years ahs recorded remarkable results and the forms and ways of application are constantly improving. The decrease of yield losses recorded due

to the application of fungicides against plant diseases, insecticides against pests and herbicides against weeds has been estimated to about 20 % in the world.

The advantage of chemical plant protection praparations is that they can be used for the treatment of large areas by means of heavy-duty machines, sir planes and helicopters which enables prompt and operative management of the situation.

Pesticides are employed in agriculture, forestry as well as human medicine, communal hygiene for foodstuff protection, against the pests of stored plant material and for disinfection, disinsection and deratization (DDD). A special chapter is that involving sanitary measures during transportation of contaminated plant material on ships and other means of transport.

During the last years, the application of pesticides has been extended practically to all agricultural plants. The role of practical plant protection consists in the application of such methods and preparations for plant protection and harmful agent control which exclude or reduce the possibility of unfavourable effects on man, environment, fodder and food.

Experience of the last years has shown that chemical preparations for plant protection eliminate in many cases the negative consequences of concentration and specialization in the plant production, such as a higher occurrence of diseases, pests and weeds in case of a monocultural crop cultivation. More and moore frequently desiccants for chemical drying of plants and as morphoregulators of growth are applied, as they considerably influence the productivity of labour, quality and technology of the cultivation treated plants as well as that of their harvest.

Only those pesticides are used in practice which are contained in the list of registered preparations. Prior to their registration the biological activity of the pesticide is assessed as well as health and special toxicological and hygienic criteria, and criteria with respect to water and living environment protection.

New problems of the plant protection against pests, diseases and weeds require a higher number of chemical preparations, more efficient substances and their rotating application. This prevents the pests and diseases from developing resistance to preparations used for a longer period of time, or to the same efficient substances applied several times. Similary, the effects against resistant weeds are ensured which were spread by many years of application of chemical preparations containing

the same active substance, or the preparations with the same spectrum of activity, e. g. MCPA, 2,4 D, atrasine, simazine, trifluraline and some others. Resistant weed control is performed by combination of the preparations immediately before the application ("tank-mix" method), or in-factory combination of several efficient compounds.

In the past, resistance to several pests of economical importance was observed in practice when combining pesticides. The rotation of pesticides prevents the cumulation of substances in the living environment which is of great importance from the aspects of hygiene and water management.

Application of chemical plant protection preparations in order to enable introducing a new technology of harvesting the crops and growth regulation of agricultural plants is carried out at a scientific level. Inevitability of their application is pointed out by the staff of inspection institutes and management sphere. This activity will expand more widely in the future.

Plant protection preparations for practical applications have different forms. Besides the classical dispersive, wettable powders, emulsifying concentrates, liquid concentrates for dilution in water, water-soluble or solid concentrates, liquid dispersable concentrates for dilution in water, powder and liquid mordants, there are special forms of preparations for application in very low doses, the so called ULV, tablets, dispersive microcapsule concentrates, aerosol containers, granulates, bags, strips or plates releasing the active substance, coating materials and other special forms.

Special demands put on the plant protection activities, observation of rules for correct application as well as comprehensive living environment protection require that the activity in the field of plant protection be performed by specialized organizations equipped with necessary technical means and qualified personnel. In the CSSR this service is performed by agrochemical enterprises, machine and tractor stations, special organizations of DDD (for the protection of stored reserves of vegetable material) and by special groups of agricultural plants.

A relatively high rate of the development of chemization in the plant protection with the corresponding growth of the plant production was recorded especially in the first half of the seventies. In 1970—1975 the annual increment of chemical treatment represented 13 %. In the period 1976—1980 certain stagnation was taking place. In this period also the home production of pesticides started and continues to stagnate.

Stagnation of the pesticide production and shortages in their assortment have unfavourable impact on the present level of protection of cereals and other crops. It is necessary to perform weed control in all crops grown on arable land. It is necessary to weed all kinds of cereals, maize for grain and silage, legumes, potatoes, sugar beet, winter rape, sunflower, flax, soya, poppy, other seed oil crops as well as of hemp, tobacco, red pepper sorghum, chamomile and spring mixed crops. It concerns also feed tuber crops, hop- gardens, vineyards, stone fruit and pome fruit orchards, tomatoes, cucumbers, onion, garlic, strawberries, cabbage, carrot, spinach, lettuce and other vegetables.

The Czechoslovak chemical industry manufactures three active substances for herbicides which is not enough to cover the requirements. Therefore output from the production programme Agro II and Agro I from Duslo Šaľa, Natl. Corp. should improve total plant protection with herbicides, fungicides and insecticides.

In cereals as well as in other crops monocotyledonous and other resistant weeds are selected. A serious problem of the last years causes coushe grass which is almost the limiting factor of crops. It occurs mostly in the regions of North Bohemia, East Bohemia, North Moravia as well as in the East Slovakian and Mid-Slovakian regions.

Besides the herbicide programme it is necessary to develop also the programme of special fungicides for field crops, vegetable, fruit growing and vinegrowing. As for the insecticides it is necessary to develop production of preparations against voracious and suckling pests including mites.

Experience of the last years shows the necessity of a substantial elargement of the assortment of fungicides with preventive effects and addition of new, specific fungicides with curative effects which find application possibilities in case of serious infections of individual diseases.

Of the total volume of chemical plant protection in the CSSR, weed control by herbicides amounts to 59 %, 15 % by fungicides, 15 % by growth morphoregulators, 8 % by insecticides, 2.8 % by desiccation and 0.2 % by rodonticides.

Herbicides were used for some plants even twice, particularly in case of weaker effects in dry periods, when imported contact herbicides were applied especially to sugar beet, vegeables and other crops.

When considering the total development of plant protection in the CSSR it is clear that a thorough comprehensive solution of the problems is required. The decisive turn in the unsatisfactory situation with pesticides supply should be made especially by increasing the home production. At the same time, this is a prerequisite for a more extensive utilization of the possibilities offered by the international cooperation within the framework of the Council of for Mutual and Economic Assistance.

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WEED CONTROL IN FORESTRY

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[Article by Ing. Olga Valkova, CSc.]

[Text]

One of the many products of chemical industry are pesticides the application of which has been considerably expanded also in forestry during the last decade. The present modern protection of forests is hardly possible without application of pesticides as chemization is of undeviable importance for the whole national economy including forestry. When comparing the amount of applied pesticides in agriculture and forestry, the latter is rather low (ranging from 0.5—1 %); however, it becomes more and more important as the forest fulfils significant functions (water source, air pollution control, etc.) in the present era of scientific and technological progress.

The most important chemical preparations applied to forestry are *phytocides*, i. e. preparations for plant vegetation control. These include *herbicides* (weed control), *arboricides* (undesirable bushes and trees control), *defoliants*, etc. The most frequently applied herbicides and arboricides in forestry are those on the basis of phenoxyacids 2,4,5-T and 2,4-D, dalaphone, TCA and some triazine compounds. Natural environment is mostly influenced by insecticides followed by herbicides and fungicides. Herbicides include particularly the triazine-based compounds, urea derivatives and picloram, criticized because of their residual effects or degradation of toxic residues in soil. Due to a relatively long persistence one should mention here trifluraline, dalapone and TCA. Among ecologic factors influencing herbicide behaviour in soil also sorption capacity, organic matter content, biological activity of soil microorganisms etc. should be mentioned here in addition to climatic conditions.

Chemical control of undesirable plants (weeds) started practically after World War II, when the application of insecticides was quite common. Since that time, however, application of herbicides is ever increasing the same as the prognoses predicting an increase in their absolute and relative share in the aplication of all pesticides in the nearest future. It has been demonstrated that the application of herbicides in forestry results in an increased productivity of labour, reduction of total costs and share of live work (as much as 50 %). Thus, herbicides are important chemical agents even in this sphere of national economy. One should realize, however, that the application of herbicides has also negative effects. Like any biocide agent also herbicides can have unfavourable effects. Then can involve also direct or individual risks for human organism (Válková 1975).

One of very serious factors negatively influencing the production of seedlings in tree nurseries and rooting of seedlings is the incidence weeds.

There are many studies in the world literature on forestry (Smirnov 1971, Wilde et al. 1968, Böhm 1973, Ciannini 1973, Huss et al. 1970, etc.) dealing with the negative effects of excessive weed growth (excessive production of phytomass) in relation to nutrient intake, water consumption and decretion and decrease on quality (smaller growth in height and thickness) of seedlings and plants. Sometimes the weed provides certain protection to young woods (slight shade, reduction of temperature differences and the like), early budding species can be the only source of fodder for animals in spring, and the like. Positive aspects of weed growth are, however, outweighted by its harmful effects on the development of seedlings and young plants.

Application of herbicides and phytocides in general is becoming ever more important as the forest is an important factor in the area of springs, it is important for air protection, recreation, etc. In the last few years the application of herbicides to forestry was criticized not only by specialists but as well by public at large. Response of the public is frequently emotional without sufficient information, based on certain press campaigns, etc.

Regarding the fact that the permanent tendency of rationalization in forestry needs the help of chemical industry, we have to count on the application of pesticides in the nearest future, too. It is necessary, however, to use less persistent and less toxic preparations, to keep exactly the quality and technology of the application so as to prevent any emergencies that might seriously shift the biological equilibrium of the forest ecosystem even for a longer period of time.

To the efficient, the struggle against undesirable vegetation must become part of a whole complex of measures that must be strictly observed. One has to take into consideration, however, that the methods of control depend on the particularities of biology of individual weeds as well as on the whole complex of the environmental conditions. Total weed control presupposes the study of biological properties of the weed species, i. e. the way and intensity of reproduction, the way of spreading the reproductive organs, regeneration capability and vitality of the organs of vegetative reproduction, relations of weeds to ecological conditions, sensitivity of the weed species to applied mechanical and chemical methods. The system of weed control is an unseparable part of the total integral plant protection in the CSSR.

Recently, attention to perfect knowledge of biology and ecology of weed species is paid also abroad as herbicides can be employed for weed control only with the knowledge of all relevant data. In the German Democratic Republik there is a research project dealing with the problems of the study of weed biology in forestry; Klebingat (1967) carried out phenological investigations on forest weeds and examined the process of germination of the seeds of some weeds in different depths of soil. At the same time, Klebingat (1970) notes that the konwledge of harmful effects of weeds and the conditions of their germination is the basis of systematic and rational application of herbicides to forestry.

In the tree nurseries the weed control costs represent a substantial part of total expences, and it is necessary to pay more attention to new rationalization methods as it is exactly in the tree nurseries where the requirements for manpower are significantly affected.

Among prevailing species of weeds we must mention at least some, such as annual meadow grass (Poa annua), Sagina procumbens chickweed (Stellaria media), shepherd's purse (Capsella bursa-pastoris), common groundsel (Senecio vulgaris), corn spurrey (Spergula arvensis), etc. Among perennial species prevail particularly the following: Rorippa silvestris, creeping thistle (Cirsium arvense), couch grass (Elyrigia repens) as well as a number of others as resulting from examinations in individual tree nurseries. Each tree nursery has its specific spectrum of weeds which depends particularly on the environment of the tree nursery (e. g. vicinity of agricultural land, soil, altitude above sea level, cenotic classification, etc.

Problems appear with the occurence of the secondary flora when the application of a certain herbicide results in one-sided suppression of one part of vegetation which is followed by the selection of other resistant species that were suppressed prior to this application (Pluquot 1969). To eliminate these undesirable consequences, combinations of herbicides are prepared which have effects on a broader spectrum of species.

It is understandable that maximum attention is paid to the rationalization of weeding in the tree nurseries and therefore application of chemical preparations with selective effects in some wood species is welcome in the forestry practice. Recently, preparations on the basis of hexazione were found very good because of their selectivity to the pine tree (Photo p.). After the first experiments of safe applications to pine cultures this preparation started to be used in the tree nurseries, too. It was applied to the pine tree nurseries, then to the planted pines in the second year and finally, very low doses were used in the application to pine seedlings. Herbicides are applied particularly in the preparation of soil for afforestation where the intensive growth of weeds prevents the development of new plants. This way of weed control is one of the most desirable ones as it reduces competition of the weed vegetation in the first years of the development of planted trees. Serious problems are caused by monocotyledonous weeds such as Calamgrotis spigeios) L. (Roth) and Calamgrositis villosa (Chaix) Gmel.; of the dicotyledonous one should mention bilberries (Vaccinium myrtillus L.), heather (Calluna vulgaris L. (Hull.), Petasites albus (L.) (Gaertn.) and in some regions also Pteridium aquilinum (L.) (Kuhn). The wedd control during afforestation is followed by protection against weeds where it is necessary to pary attention to the selection of the preparation with respect to the treated target wood species, eventually to protect the cultural wood species against the effects of chemical spraying.

During 1977—1978 attention was paid in the CSR to the Pteridium aquilinum control in the area of the Vrchlabí forest plant. A series of experiments with some special preparations at different doses was carried out (some of them are selective for the above weed species):

1. *Aminotriazole* (50 % of act. subs. of amitrole) at a dose of 30 kg per hectare
2. *Asulox* (400 g of act. subs. of asulam) at doses of 6—11.4—27.5 l per hectare
3. *Garlon* 3A (300 g/l of act. subs. of triclopyr per liter at doses of 8—10 l per hectare
4. *Krenite* (420 g of act. subs. of fosamine ammonia per liter) at a dose of 10 l per hectare
5. *Velpar* 90 WSP (90 % of act. subs. of hexazinone) at doses of 6—8—10 kg per hectare
6. *Tordon* 225 Mixture (15.2 % of act. subs. of picloram and 14.9 % of act. subs. 2. 4.5-T) at a dose of 5 l per hectare.

A survey and comparison of the effects of individual preparations and their doses is given in Tab. 1. For completeness it is necessary to mention that above survey (because of the complicated method of calculation and weighing) does not include those preparation which did not show any effects on Pteridium aquilinum)

(e. g. Tordon, or their effects were rather insignificant from the aspects of utilization in practice

(Garlon 3 A at both doses, when the occurence of this weed on the treated areas was almost equivalent to those on the control area; only the fans were deformed and moreover some pine trees were damaged). Neither Krenite had any significant effects which was due to the time of application or some other factors. Detailed evaluation does not incluade Velpar at a dose of 10 kg per hectare as its effects on undesirable vegetation were almost 100 % (as in case of lower doses). However, from the aspects of economy the application is not a feasible one and also high doses against Pteridium aquilinum are not necessary. The herbicide effects were evaluated by taking five control squares of 1 m^2 from each experimental plot. From the values obtained mean m^2 was calculated (therefore the figures have one decimal place) and tabulated.

It is to be emphasized that the preparation given in the comparison table had no harmful effects on the pine trees. It is of interest that after the application of hexazinone-based preparations in areas with interspersed oak trees, the oak was not damaged either. It was necessary to distinguish between the effects on Pteridium aquilinum and those on other species so as to avoid misinterpretation of the results as some preparations have no effects on monocotyledonous species (Asulox). At the same time, the table indicates a low number of weed species when the dominating Pteridium aquilinum is able to suppress any other species — as is the case of other high weeds (e. g. Petasites albus —

which form a dense cover with their aboveground parts being thus serious competitors for the target wood species because of mechanical effects (pressure, shade) as well as because of excessive nutrients, light and air requirements.

Table 2 presenting data on the effects of hexazinone-based preparations applied to the pine wood — beginning of the application — documents the importance of a comparison of individual doses not only from the aspects of economy but also from the aspects of environmental protection: i. e. to prevent applying unnecessarily high doses of chemical preparations for weed protection in forest growths when — after comparison of the effects on

Table 1

Decrease in the weed intensity after treatment against (Pteridium aquilinum (L.) Kuhn)

Method: numbers — weight

Locality: LZ Vrchlabí (LS Nemojov) Application: 11th July, 1977

Culture: Pine Control: 26th Sept., 1978

Weed spieces		Pieces (veget. tops) on 1 m² plot						
		Dose in kg (liters) per hectare						
		ATA		AULOX		VELPAR		Control
		30	6	11,5	27.5	6	8	
Agrostis vulgaris			0.6	0.2				
Avenalla flexuosa		0.2	22.0	0.2	1.4	1.4	0.6	27.6
Calamagrostis arundinacea			180.0					
Calluna vulgaris						0.6	0.2	
Chamaenarion angustifolium				0.2				
Pteridium aquilinum		4.0	5.8	0.2				
Rubus idaeus					1.0			
Vaccinium myrtillus		114.8	51.0	11.4	28.6	15.4	5.8	26.4
Vaccinium vitis-idaea		4.8		0.6	17.0			
Varia							0.2	
Total: Pteridium aquilinum	ks	4.0	5.8	0.2	0.4	1.4	2,2	41.0
Others	ks	119.8	253.6	12.6	48.0	17.4	6.8	54.0
Loss: Pteridium aquilinum	ks	37.0	35.2	40.8	40.6	39.6	38.8	
	%	90.0	86.0	100.0	99.0	97.0	95.0	
Others	ks	+65.8	+199.6	41.4	6.0	36.6	47.2	
	%	+122.0	+370.0	77.0	11.0	68.0	86.0	
Dry matter weigh: Pteridium aquilinum	g	16.04	30.08	0.67	0.37	3.31	0.74	305.60
Others	g	84.67	70.15	3.93	30.53	6.37	5.63	17.76
Loss: Pteridium aquilinum	g	289,56	275.52	304.93	305.93 23	302,29	304.85	
	%	95.0	90.0	100.0	100,0	99.0	100.0	
Others	g	+66,91	+52,39	13,83	+12,77	11,39	12,13	
	%	+377,0	+295,0	78,0	72,0	64,0	68,0	

individual species — it is clear that higher doses do not extend the spectrum of effects. This can only result in the persistence of toxic residues of the active substances which must never happen to the forester using pesticides for wood species protection.

The above mentioned examples involve hexazinone-based preparations in the form of a wettable powder the effects of which on weed at the present selectivity in the pine woods are known among a number of people working in forestry. It is quite understandable that in some not easily accessible areas the transportation of water for preparation of spraying material is rather difficult, and therefore a hexazinone-based preparation in the form of granules was welcome as this enables application by special adapters without water. The active substance is absorbed from soil through roots, only rarely through leaves only if some granules remain on the surface of leaves only if some granules remain on the surface of leaves. This form is highly

suitable for applications in afforested zones. Granulated herbicides find wide application possibilities in forestry especially due to the fact that no water is necessary for their application, as the transport of water is often very difficult in a complicated configuration of the terrcin. However, it is necessary to consider in which area such products can be applied as it was found in our experiments that the granulated preparations need sufficient moisture to be efficient. This has been proved also by experience abroad (e. g. Kerb). In our conditions we can recommend to apply the hexazinone-based granulated preparation early in spring (on the show) so as to make use of the soil moisture from thawing snow.

Table 2
Decrease in the intensity of weeds after VELPAR application at different doses
Method: number-weight
Locality: VLS Horní Planá
LHC Dobrá Voda, 41 a_2

Application: 25th July, 1975 (8 kg per hect.) 20th May 1976 (2,4 kg per hec.)
Culture: Pine
Control: 27th Oct., 1976

Weed species		Pieces (veget. tops) on 1 m² plot			
		Dose in kg per hectare			
		2	4	8	Control
Agrostis tenuis + stolonifera		1,0	1,3	1,0	(1429,7)
Ajuga reptans				1,7	8,0
Avenella flexuosa			0,3		(130,0)
Calamagrostis arundinacea					(2,7)
Deschampsia caespitosa			0,3		
Epilobium montanum			0,7		
Epilobium sp.					0,3
Epipactis helleborine					0,3
Fragaria vesca					4,3
Hypericum maculatum					5,0
H. perforatum					1,3
Luzula nemorosa					(8,0)
Moehringia trinervia				0,3	
Potentilla erecta					(3,0)
Prunus spinosa					0,3
Ranunculus lanuginosus				0,3	
Rosa sp.			0,7		
Rubus idaeus		0,3		0,3	(54,7)
Urtica diodica		(1,3)	0,3		(4,0)
Vaccinium myrtillus		(3,7)	(3,7)	(2,0)	(10,0)
Veronica chamaedrys					(4,7)
Viola silvatica		1,7		1,0	1,7
E_1 juv:					
Sambucus racemosa					1,3
Sorbus aucuparia					1,3
Weeds total —	pcs.	8,0	7,3	6,6	1671,0
Weed loss —	pcs.	1663,0	1663,7	1664,4	
	%	±100,0	±100,0	±100,0	
Dry matter — total	g	4,25	1,58	1,85	217,91
Loss of dry matter	g	213,66	216,33	216,06	
	%	98,0	99,0	99,0	

As for the control of some undesirable wood species we have to state that with respect to environmental protection these will have to be removed first of all mechanically (employing small mechanization) or by manual cutting, and only in justified cases chemical control will be allowed. In forestry, arboricide preparations are used for such a control — they are either sprayed on the trunk or leaves or special injectors or axes are used. Till now preparations on the basis of 2,4,5-T and some others have been used. The results obtained with the fosamine ammonia based preparations are not quite unequivocal in our studies because a thorough eradication and thus a serious evaluation requires at least two vegetation periods. This calls for a completely new view of the forestry practice as the hitherto experience with arboricides has shown relatively rapid effects already during one vegetation period. On the other hand the preparation on the basis of fosamine ammonia can be considered as a preparation of the second generation which requires a new approach of forestry and public as well.

At present, gyfosate-based preparation finds its application possibilities in the Czechoslovak forestry (360 of act. subst. per liter); it is a leaf herbicide with systemic effects. It is taken in by green parts of plants and through the plant liquors it is transported to the root system. It can be recommended particularly in such cases when persisting residues should be avoided in soil (e. g. in tree nurseries), as the preparation has no residues. However, there is a possibility of the development of the so-called secondary flora (see p.): the weed grows from the seeds remaining in soil, or such species of weeds can appear which were suppressed.

Maximum application possibility of this preparation is in the undesirable wood species control, eventually of their seedlings as from the aspects of the living environment protection no dilution in oil is necessary and water is used for coating or spraying. Application is quite safe (without intoxication) and oil is saved, too.

The prerequisite for positive effects of herbicides in forestry is a through knowledge on the possibilities of their application as well as on the risks involved in the herbicide application.

Herbicides — as any other biocide substances — can have adverse secondary effects. Some herbicides were criticized from the aspects of residual effects, or there are objections against hormone-type substances, and the like. Of course, the side effects of chemical preparations are not known during their development and sometimes it takes

many years before they are found. And therefore it is necessary to avoid any mistake in the applivation of substances known at first as safe (direct exposure of man at handling, overdosing, water contamination, etc.).

In the conclusion we would like to state that in spite of some negative secondary phenomena brought about by herbicide application, they are and will remain an important factor for weed control in forestry. We have no means of replacing them — as is the case of the biological pest control which is in its first phase of development and finds application possibilities especially in the insect control. The biological weed control be performed in our geographic latitudes in the nearest decades (Jansen 1973). It is necessary, however, to employ the herbicides carefully; they should only complete the proper care and agrotechnics and all principles of integral protection must be observed during their application.

The forestry personnel of all categories must be familiar with the properties of chemical agents. When selecting the herbicide for application it is necessary to prefer less toxic ones or those with a lower ability to accumulate residues in soil, methods which contribute to the environmental pollution should be limited to minimum and even picking up fruits from areas treated by herbicides should be limited, and the like.

The above mentioned application possibilities of pesticides for forest protection at a minimum contamination of the living environment prove that there are ways and methods how tho restrict the danger resulting from the application of chemical agents to the forest ecosystem. On the contrary, purposeful and well-pondered application of pesticides — provided the fulfilment of all requirements for maximum reduction of the danger of side effects — will constitute an unavoidable component of forest cultivation and protection.

CSO: 2020/58

USE OF PESTICIDES IN FORESTRY

Bratislava CHEMICAL REVIEW in English Apr 82 pp 32-36

[Article by Ing. Miroslav Srot, CSc.]

[Text]

Losses in forest growths due to abiotic and biotic agents have considerably increased in Bohemia and Moravia during the last years. Continuous increase in emissions has a detrimental effect especially on coniferous trees which are invaded by a number of harmful biotic agents, especially various leafeating pests which occurred only sporadically in the past. For instance, larch shoot moth (Zeiraphera diniana Guen.) has prevailed since 1977 on vast areas in the spruce forests damaged by emissions in the Western region of the Ore Mountains, the Jizera Mountains and the Giant Mountains. Also the social spruce fly (Cephalcia abietis L.) prevails at present in the spruce forests of all regions of Bohemia and Moravia. In the spruce copses caterpillars of spruce sawfly (Pristiphora abietina Christ.) appear in high quantities. Gradation of pine moth (Bupalus piniarius L.) was recorded in 1980—1981 in East Bohemia in the region of the forest plant Vysoké Chvojno, the pine forests of which were also damaged by emissions on an area of about 1,500 hectares.

In order to prevent the proliferation of these pests it was necessary to perform extensive chemical treatment of the afflicted growth. While in 1970—1978 max. 5,000 hectares of forests were treated by airplanes in the CSR, in 1980—1981 the control of these pests was performed every year on total area of about 40,000 hectares.

Application of insecticides against defoliators is presently still the most economic and efficient way of the forest growth protection. Since 1944 mostly insecticides on the basis of chlorinated hydrocarbons were used for chemical protection in the CSSR and abroad; these preparations with DDT as active substance were highly toxic for insects eating up the assimilation organs of plants. First, they

applied in the form of powders, later as aqueous and oil sprays. However, due to their high toxicity to warm-blooded animals, their long lasting residues and cumulative properties, the application of chlorinated insecticides to large areas was forbidden in 1974, the same as in a number developed countries. Therefore, it was necessary to test promptly other suitable insecticides which would replace the chlorinated hydrocarbons as for their effects on pests, but which would minimize the danger for warm-blooded animals and which would not pollute living environment. Preparations on the basis of organic phosphorus compounds were considered, followed later by insecticides from the group of pyrethroids and carbamates. Thus, for instances, in the USSR preparations from the group of organic phosphorus compounds, e. g. Chlorofos, Benzofosfát, Metylnitrofos, Bromofos, Gardona and the like were successfully tested against pine lappet moth (Dendrolimus pini R.), pine moth (Bupalus piniarius L.) and others (Yanin V., 1975, Vitalev A. 1975, Kuteev F., Andreeva G. 1972, Chramtsov N. 1977). During the chemical treatment also the toxicity of these preparations for soil vertebrates was observed (Atlavinite O., Kilik V., Yavichius A. 1978). In Poland effects of Actellic 50 EC, Ekamet 50 EC, and Owadofos on the caterpillars of gipsy moth (Lamantria Dispar L.) and gold tail (Euproctis chrysorrhoea L.) in oak forests were tested. Their application resulted in a more than 90 % eradication of caterpillars (Kaminski J., Karaszewska M., 1978). Extensive experiments were carried out in Poland in 1978—1980 with pyrethroid preparations (Ripcord 40 EC, Decis 2,5 EC, Ambush 25 EC and Cymbush 25 EC) applied by means of airplanes to pine forests against the caterpillars of blackarched tussock (Lymantria monacha L.). The chemical treatment was successful as the population density of these pests dropped by 90 %. In the last few years a new biotechnical preparation Dimilin 25 WP (active substance: difluorobezurome) was used in some European countries, e. g. in France and the Federal Republic of Germany; the preparation shows effects on the earliest developmental phases of caterpillars of defoliating pests, e. g. gipsy moth (Lymantria dispar L.), gree oak leaf roller (Tortrix viridana L.), processionary moth (Thaumetopoea processionea L.) and procession moth (Thaumetopoea pinivora Tr.) (Demolin G. 1978).

Also in the Czech regions a number of preparations from the groups of organic compounds of phosphorus, carbamates and pyrethroides were tested, as well as the biotechnical preparation Dimilin 25 WP and a new preparation from the group of nereistoxins Evisekt 50 SP: the preparations were

applied by airplanes to forests against defoliating pests which have been controlled with success. Table 1 presents preparations which were used in the experiments, their active substance and manufacturers. To ascertain the biological activity of the tested preparations in the control of the caterpillars of defoliating pests in forests, 1 m long boughs were taken from the tree tops of sample spruces and live and naturally died caterpillars were counted prior to application. Similar analyses of the same sample trees were performed 5 to 10 days after the application. Natural mortality of the caterpillars was observed at the same time in untreated control plots.

Downfall sheets of 1 m^2 were placed under the top of trees in the plots to be treated and immediately after the application reactions of the fallen insects were examined.

Even before the chlorinated hydrocarbons were forbidden to be used, an organophosphate preparation called Metation aerosol 20 % was tested in 1970—1971 in the control of the caterpillars of larch shoot moth (Zeiraphera diniana Guen.) in the spruce forests of the Ore Mountains, in a dose of 7 l of preparation per 1 hectare. At the same time, a preparation for the control of the caterpillars of green oak leaf roller (Tortrix viridana L.) and the caterpillars of winter moth (Operophtera brumata L.) at a dose of 6 l per hectare was applied. In the north Moravia Metation aerosol 20 % was applied at a dose of 4 and 6 l per hectare to the spruce forests seriously afflicted by caterpillars of the spruce sawfly (Pristiphora abietina Chr.). Although the mortality of the caterpillars of these pests after the application was high (95 % mortality of the caterpillars of the larch shoot moth and the caterpillars of the sprucesawfly and 80 % mortality of the green oak leaf roller caterpillars and winter moth), the preparation could not be recommended for further aerial applications as the treatment by the preparation had adverse effects especially on riverine growths due to its high toxicity to small birds. Therefore, the preparation Metation aerosol 20 % was excluded from the production programme.

In the next years during experiments with aerial applications of preparations against the caterpillars of vapourer moth in south-west Moravia at Velké Meziříčí, and caterpillars of larch shoot moth in the Jizera Mountains and the Giant Mountains, the organophosphate preparations known as Actellic 50 EC (in doses of 0.5 l per 1 hectare) and Fekama 5A AT (in a dose of 4 l per 1 hectare) were used. 100 l of water were used per 1 hectare in each

application. Better results were obtained in the application of Actellic 50 EC when the mean mortality of the caterpillars of vapourer moth was 90 % and that of the larch shoot moth 76 %. When using the Fekama 50 AT preparation the mortality of the vapourer moth caterpillars was 84 % and of the larch shoot moth only 70 %.

As the youngest caterpillars of the larch shoot moth (1st and 2nd growth class) are hidden under the caps on budding shoots of spruces it was recommended to add 0.15 l of the pyrethroid preparation ambush 25 EC per 1 hectare to 1 liter of Actellic 50 AC and thus to increase their activity and speed up their contact with chemical spray. After the application of such a combined substance the results were by 10 %—15 % higher in case of the larch shoot moth (85—90 % mortality) than those when applying only Actellic 50 EC.

In 1980—1981 other pyrethroid preparations were tested for the larch shoot moth control besides the above mentioned organophosphate insecticides, such as Cymbush 25 EC at a dose of 0.15 l/hectare and a new preparation known as Evisekt 50 SP at a dose of 1 Kg/hectare. The preparations were applied by the Mi2 helicopter to spruce forests in the west region of the Ore Mountains. 100 l water were applied to 1 hectare. After the evaluation it was found that all preparations applied showed a high effect on the caterpillars of the larch shoot moth. Mortality on the experimental plots treated with pyrethroides Cymbush 25 EC and Decis 2,5 EC was 90 % and on the plot treated with Evisekt 50 SP their population dropped down by 85 to 90 %.

Aerial chemical application of preparations against spruce fly was directed against the imagos of this pest. Good results were achieved only when applying the preparations with DDT and HCH as active substances. When these were forbidden, Actellic 50 EC was used at a dose of 1 liter per hectare.

As the active substance of this insecticide degrades rather quickly in nature and the imagos of the spruce fly are hatched over a longer period of time (2 to 3 weeks) their density dropped only by 40—50 %. Consequently, higher egg production is recorded from the females survining the application with the ensuing medium or even high proliferation of pests. On the basis of this experience it was recommended to perform in 1981 chemical treatment against the caterpillars of the 1st and 2nd growth phases in the plots with high occurrence. On larger plots Actellic 50 EC was used in a dose of 1 l/hectare and in the regions without any danger of contaminating the waters with fish, 0.15 l of Ambush 25 EC/hectare was added. Besides

Cymbush 10 EC in a dose of 0.30 l/hectare, Ripcord 20 EC in a dose of 0.15 l/hectare, carbamate preparation Sevin XLR in a dose of 2 l/hectare, Evisect 50 SP in a dose of 1 kg per hectare and a biotechnical preparation Dimilin 25 WP a dose of 0.30 and 0.40 kg per hectare. The preparations were applied against the youngest caterpillars of spruce fly usually in the first half of July (Tabl. 2).

After the evaluation of the results of chemical treatment the highest efficiency was noted against the caterpillars of spruce fly when applying Evisect 50 SP, as their mortality was higher than 95 % and the average number of dead caterpillars on a downfall sheet of an area of 1 m^2 was 683 individuals. Aslo in the application of this preparation on adult caterpillars of spruce fly (3rd and 4th growth phases) a mortality of 90 % was recorded and the average of 570 dead caterpillars were found on one downfall sheet (max. 917 bodies). Good results were achieved with the biotechnical preparation of Dimilin 25 WP: when applying lower doses (0.30 kg of preparation per hectare) 80 % mortality of caterpillars of the 1st and 2nd growth phases was recorded, and higher doses (0.40 kg per hectare) increased the mortality of caterpillars to 90 %. Toxicity of other insecticides based on organic compounds of phosphorus, pyrethroides and carbamates on the caterpillars of spruce saw fly was considerably lower, as only 9—45 % of individuals died after their application. The caterpillars in the dropping bags were affected by these preparations with prevailing contact effects only insignificantly. Only when using Actellic 50 EC with an addition of Ambush 25 EC, max. 70 % mortality of caterpillars was recorded due to the fumigation ability and irritating effect of this mixture of compounds.

When treating the pine forests invaded by the pine moth (Bupalus piniarius L.) in the East Bohemia in the neighbourhood of the forest plant Vysoké Chvojno several mixtures of Actellic 50 EC plus Ambush 25 EC were tested as for their effects on the caterpillars of this pest (of the 2nd—3rd growth phases), as well as pyrethroid preparations Ripcord 20 EC in a dose of 0.15 l/hectare, Decis 2,5 EC in a dose of 0.15 and 0.20 l/hectare and carbamate preparation Sevin SLR in a dose of 2 l/hectare. The preparations were applied by the AN 2, dosing 100 l of water per 1 hectare. All applied insecticides showed reliable effects on the caterpillars of the pine moth; mortality on all experimental plots was 85—97 %. The highest mortality was reached using these compounds also other pyrethroid preparations were tested on smaller plots (20—100 hectares), such as Decis 2,5 EC in a dose of 0.20 l/hectare, Cymbush 25 EC in a dose of 0.15 l/hectare and

the pyrethroid preparations Decis 2,5 EC and Ripcord 20 EC (the mean value being 95 %). One or two hours after the application a great number of spasmodic caterpillars were found having falled down from the tree tops.

Conclusion: When treating the spruce forests against the vapourer moth, larch moth and pine forests against the pine moth, Actellic 50 EC was found to be the best from the group of organic compounds of phosphorus, and Decis 2,5 EC, Cymbush 25 EC and Ripcord EC from pyrethroides. When using Actellic 50 EC the toxicity to the caterpillars of pests was increased by the addition of a smaller amount of Ambush 25 EC (0.15 l/hectare). Evisect 50 SP from the group of nereistoxines with

Table 1
Preparations used for aerial treatment of forests in the CSR against defoliating pests

Preparation		Manufacturer (Country)
Name	Active substance	
Actellic 50 EC	pirimiphos-methyl	Plant Protection Limited, England (Finalized in Spolana CSSR
Fekama 50 AT	butonat	VEB Fettchemie, GDR
Metation-aerosol 20 %	fenitrothion	CHZJD, ČSSR (omitted)
Ambush 25 EC	permethrin	Plant Protection Limited, England
Cymbush 25 EC	cypermethrin	Plant Protection Limited, England
Decis 2,5 EC	dekamethrin	Roussel Uclaf, France
Ripcord 20 EC	cypermethrin	Shell International Petroleum Co., Angl
Sevin XLR 43 %	carbaryl	Union Carbide Corporation, USA
Dimilin 25 DP	diflubenzuron	Philips-Duphar B. V., Netherlands
Evisekt S 50 SP	thiocyklamhydrogenoxalat	Sandoz A. G., Switzerland

Table 2
Effects of the preparations used for aerial application to forests against defoliating pests

Preparation	Dose kg/hect.	Average effects on caterpillars in %			
		Larch shoot moth (Zeiraphera diniana)	Pine moth (Bupalus piniarius)	Spruce fly (Cephalcia abietis)	Vapourer moth (Orgyia antiqua)
Actellic 50 EC	0,50	—	—	—	90
	1,00	76	82	45	—
Actellic 50 EC + Ambusch 25 EC	1,00 + 0,15	88	92	67	—
Fekama 50 AT	4,00	70	—	—	84
Cymbush 25 EC	0,15	90	—	16	—
Decis 2,5 EC	0,15	92	94	14	—
	0,20	—	97	19	—
Ripcord 20 EC	0,15	—	94	11	—
Sevin XLR	2,00	—	84	9	—
Dimilin 25 DP	0,35	—	—	80	—
	0,40	—	—	90	—
Evisekt S 50 SP	1,00	88	—	96	—

Note: Preparation was not used

contact effects and partially systemic effects was found to have high effects on the caterpillars of the larch shoot moth.

When protecting the spruce growths against the invasion of spruce saw flies chemical treatment against the coungest caterpillars of the 1st and 2nd growth phases must be performed. The highest mortality (over 90 %) resulted from the application of Evisect 50 SP (1 kg/hectare) and the biotechnological preparation Dimilin 25 WP (0.40 kg/hectare). After the treatment by these preparations no significant mortality of useful insect species was observed. Only sporadical mortality of the flies from the Ichneumonidae familly was observed and their population density was not significantly reduced.

Application of Pyrethroid preparations Ripcord 20 EC, Decis 2,5 EC, Cymbush 25 EC and carbamate preparation Sevin XLR on the caterpillars of the spruce saw fly showed little efficiency as the mortality of caterpillars did not exceed 20 %. These contact insecticides affected only a low number of caterpillars in the dropping bags.

To conclude, one can state that the preparations which were tested and recommended for the aerial treatment of forests against defoliating pests are not toxic for warm-blooded animals and do not show any cumulative properties. Majority of the compounds tested were sufficiently active in case of the proliferation of pests and, therefore, these preparations can substitute for those on the basis of chlorinated carbohydrates employed in the past for aerial treatment.

CSO: 2020/59

PRODUCTION, QUALITY IMPROVEMENT OF CHEMICAL FERTILIZERS

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[Article by Ing. Jan Palka, CSc., Ing. Anton Jantula, Ing. Juraj Synak, CSc.]

[Text]

Nutrition of the population is a serious problem standing in the focus of attention of the world-wide organizations (UNO) and countries (the 4th Plenum of the Communist Party of the CSSR). Methods are sought for increasing the food production, particularly through plant production intensification. All over the world, the loss of agricultural land and population growth — two contradictory factors — are recorded.

The role of agriculture — according to Viljams — consists in the transformation of kinetic (solar) energy into potential energy, i. e. food for people.

Which factors are participating in the fulfilment of this role and what are their respective shares? Soil, climatic conditions, soil cultivation, fertilizers, plant protection and used varieties. The share of the above factors has changed in the CSSR over a period of 25 years (1948—1973) as follows:

Table 1

Factor	1948	1973
Soil	40 %	10 %
Climatic influences	20 %	15 %
Soil cultivation	20 %	10 %
Fertilizers	10 %	30 %
Plant protection	5 %	15 %
Variety	5 %	20 %

The first two factors of Table 1 are determined by the nature. The remaining ones are affected by man. Three of these are affected directly by workers of agricultural plants, fertilizers and plant protection are determined by chemical works and thus, the farmer controls only the application of chemical products. The last factor is affected espe-

cially by workers of breeding stations. New varietes give better yield, they can better utilize the nutrients from industrial fertilizers; however, they are more sensitive to plant pests.

The shift from the predominant influence of the first three factors (from 80 % in 1948 to 35 % in 1973) to that of chemization (fertilizers and plant protection) and breeding efforts (20 % in 1948, 65 % in 1973) indicate the importance of fertilizers. Consumption of fertilizers does not rise only in the CSSR but all over the world. This is evident from the survey of the consumption of fertilizers in the world during the last thirty years.

Table 2

Continent	1950	1960	1970	1980
Europe (including the USSR)	7.6	15.5	34.8	52.5
North America	4.3	7.5	15.7	22.4
Latin America	0.3	0.9	2.9	6.5
Africa	0.3	0.7	1.6	2.9
Asia	1.0	3.9	11.6	24.4
Oceania	0.4	0.9	1.4	2.0
Total	13.9	29.4	68.0	110.7

The consumption of fertilizers in the world doubled over a period of 10 years. The highest growth rate moves, however, from industrialized countries to socialist countries.

Powder, Granulated and Liquid Fertilizers

The production of industrial fertilizers has a relatively short history. During the development the form of fertilizer was changing from powder one (superphosphates, nitrogen lime, ammonium sulphate, potassium salt) into granulated fertilizers, and from granulated to liquid ones. Granulated form of fertilizers has several advantages: their handling is easier and their distribution on the soil surface is more even. Granulated fertilizers can be packed in bags which enables more exact dosing. The development of granulated fortilizers aimed at:

— reduction of the granulometric spectrum
— mixability with other types of fertilizers with granules of the same size
— protection of fertilizers against sintering
— change from packed fertilizers to loose fertilizers

Liquid fertilizers are fertilizers of a new generation. The liquid form offers other advantages unknown in case of the solid ones:

— practically ideal distribution of nutrients over the soil surface
— perfect mechanization of hangling along the whole flow from the manufacturer to the field application

— incerase of nutrient availability for plants
— introduction of a rational method of fertilization of separated and foliar nutrition.

What can the Slovchémia Trust offer to the agriculture First of all, several figures

Table 3

Index	1960	1965	1970	1975	1980
Production in thousands tons of pure nutrients	46	150	295	530	637
Share of p. n. supplies by Slovchémia in CSSR	9	28	32	37	54
Average concentr.	20	23	27	33	42
Slovchémia	20	24	24	29	35
CSSR					
Share of granulated fertil. Slovchémia	—	38	49	58	79
CSSR	38	33	50	61	70
Share of multicomponent fertil. Slovchémia	0	0	31	52	54
CSSR	4	2	23	39	44
Share of liquid fertilizers Slovchémia	—	—	—	8	10
CSSR	2	1	0.8	5	6

Survey of the Slovchémia Trust products

Nitrogen fertilizers

Type	Ammonium sulphate	Saltpeter LAD 27.5	Urea fert.
Parameter			
Form	white crystals	grey granules	white granules
Nitrogen content	21	27.5	46
For 100 kg of N	476 kg	364 kg	217 kg

Multicomponent fertilizers

Type	Demetra	GVH-5	NPK-NF

Parameter			
Form	grey granules	greyish brown granules	greyish white granules
Pure nutriets in %	37.6	43.5	48.0
Of it N	11.2	8.5	16.0
P_2O_5	11.2	17.5	16.0
K_2O	15.2	17.5	16.0
Quantity per 100 kg of p. n.	270 kg	230 kg	208 kg

Liquid fertilizers Type	DAM-390	Fostim
Parameter		
Colour	colourless, clear liquid	colourless, green to black-brown (according to H_3PO_4)
pH	6.0—7.5	6—7
Weight t l	1.3 kg	1.285 kg
N in % by weight	30	8
P_2O_5 in % by weight	—	24
Pure nutrients in % — total	30	32
Nutrients in kg per 100 l	39	41
Corrosive properties	corrodes steel	does not corrode metals

What were and what are the aims of the Slovchémia Trust in the development of the production of industrial fertilizers?

Granulated fertilizers

During the development of industrial fertilizers one should bear in mind that the chemization of agriculture must not an objective per se but on the contrary, its role (according to Harmaniak) is to help to raise the yields and productivity of labour.

The effort to manufacture fertilizers with maximum of available nutrients and good properties is based on this objective. Technological properties of fertilizers are those which influence their transportation, storing and distribution, i. e. they affect the post-production operations.

Important technological properties of granulated fertilizers: — looseness — form of handling — nutrient concentration.

Looseness is an exceptionally important technological property of granulated fertilizers. Therefore, the attempts at its improvement occupy a prominent position in the Slovchémia Trust programme. The loose form is achieved by technological methods as well as by an improvement of the production conditions and surface treatment of final ready granulated fertilizers by preparations preventing

their sintering. Opinions on the loose form vary in connection with another technological property — form of handling. Imperfect and unstable loose form impairs the granulometry and thus also the evenness of distribution. It requires one additional operation and does not allow handling bulk fertilizers.

The fact whether the fertilizer is packed or not is expressed in the term *"handling form"*. The programme of agrochemical plants, the programme of cooperation and specialization of agricultural production requires mechanization of work. For this purpose fertilizers in bulk are the best. Of course, fertilizers in bulk in an agricultural plant without concenient equipment (store, transportation, etc.) cause only difficulties. Advantages of handling the fertilizers in bulk can be used only if the plant is properly equipped (stores, mechanization equipment and organization of work).

Fertillizers in bulk make the work easier, reduce the number of workers and save the costs of the manufacturer (for packing and filling) and the user. Already in 1978 the farmers submitted a requirement for 90 % of bulk fertilizers in 1990. Slovchémia creates all prerequisites to meet this demand in advance. It is necessary to develop an efficient surface treatment of fertilizers and to transport them in convenient wagons. For the moment, urea from Duslo Šaľa can be transported in bulk (the experiment with storing ended in March 1981 in Horné Ozorovce) as well as GVH from the Chemical Works of J. Dimitrov, Bratislava (the experiment with storing ended in September 1981 in the Agrochemical Plant in Veľké Meziříčí). Other fertilizers will follow. Unfortunately, the situation in the construction of agrochemical plants does not allow to fully employ the possibilities offered by Slovchémia.

Table 4
Economic effect of bulk fertilizers in agriculture

Costs	Fertilizer	
	packed	in bulk
Manufacturer's (except from the costs for production)	100 %	43.4 %
Transportation	100 %	100 %
Agricul. plant	100 %	97 %
Total	100 %	76.6 %

Concentration of nutrients in industrial fertilizers can directly influence the absolute value of their material flow. Increasing the concentration of nutrients by 1 % at the present amount of about 6 mil. tons of fertilizers per year would enable to increase the annual transport by 60.000 tons of nutrients, or to save the transportation of about 220,000 tons of material which will be reflected not only in the transportation costs but also in energy saving.

Liquid fertilizers

Liquid form was in fact the first form of industrial fertilizers. In 1840 Liebig suggested to dissolve bones in sulphuric acid and to apply this solution to soil prior to ploughing. Since that time the application of liquid fertilizers occurred sporadically, especially of ammonia water and later, of anhydrous ammonia which continues to be frequently used in some countries.

Anhydrous ammonia is the most concentrated industrial fertilizer in general (it contains more than 82 % by weight of N). Its disadvantage is, however, that it must be stored under pressure (0.8 MPa) and must be applied under the soil surface. It is bound without losses in humid and active soils. Its application requires a complete distribution system for ammonia handling, i. e. transportation equipment (in case of greater consumption transportation by pipes is recommended), storing capacities (pressure tanks), applicators (pressure vessels). In the plants without this rather costly equipment pressureless liquid fertilizers are applied more extensively.

Pressureless liquid fertilizers

This type of liquid fertilizers is represented by the aqueous solution of ammonium nitrogen and urea (DAM-390) which has not increased vapour tension and thus, handling without hermetic sealing of vessels and without over-pressure is possible. It can be transported in pressureless tanks, stored in pressureless reservoirs and applied directly to the surface or even directly on leaves. It contains 28—32 % of N, which is about 2.7 times lower than that of anhydrous ammonia, but the same or higher than that of ammonia saltpeter with limestone (27.5 % N). The rapid development of pressureless liquid fertilizers was possible just due to these properties (DAM-390 and KVH, i. e. liquid multicomponent fertilizers).

Research and development of liquid fertilizers started in Slovchémia ten years ago. In the first years a nitrogen solution of DAM-390 was prepared in Duslo Šaľa. The application of this solution was successful and aroused a great interest. The idea of liquid fertilizers gained ground and in the middle of the last five-year plan in was incorporated into the programme of agriculture. Consumption was increasing and in 1980 it reached 4.7 % of nitrogen and 0.9 % of phosphorus from the total volume of nutrients used in the form of industrial fertilizers. Slovchémia occupies the first place in the production of liquid fertilizers: in 1980 68 % of liquid fertilizers of the production of the CSSR were manufactured by the works of Slovchémia.

Advantages of liquid fertilizers

Liquid fertilizers have better technological properties than granulated ones, as they are "perfectly loose", do not sinter and handling does not require packages. Thus, they enable maximum mechanization of all works connected with transportation, storing and aplication. They save physical work and ensure high culture of labour and hygiene. Liquid fertilizers do not produce dust neither during transportation nor aplication. Their application results in the most even distribution of nutrients on the soil surface achieved so far which is impossible in case of granulated fertilizers.

Concentrations of nutrients is maintained at the level of granulated fertilizers (30, 32—44 % of suspension as much as 50 %). The year round storing is possible without any negative effects on the fertilizer quality. Crystallization temperatures are below −10 °C. If the fertilizer is cooled below this temperature and the salts crystallize out, it resumes its liquid state when heated above the temperature of crystallization.

The progressive quality of liquid fertilizers consists particularly in the fact that they do not only enable but also require a complete mechanization of all operations with the fertilizer and eliminate the physical work which is unpleasant and aven hazardous to health in case of solid fertilizers. Reduced physical strain brings about cost savings and mechanization increases the productivity of labour. Results of our biological research in agricultural plants are remarkable:

a. direct cost savings
b. live work saving
c. savings of mechanical work.

In selected agricultural plants with an increased representation of liquid fertilizers the following parameters were achieved during the year-round application:

Table 7

Parameter	Solid fertilizer packed	Solid fertilizer in bulk	Liquid fertilizer
Direct handling costs	—	100 %	50—41 %
Live work requirements	100 % (100 %)	— (34—50 %)	17.6 % (15 %)
Mechanical work requirements	4.2 h/t 2.6 h/t (100 %)	1.1—1.4 h/t 1.17 h/t (45 %)	0.63—0.65 h/t 0.65 h/t (25 %)

The saving of mechanized work resulting in reduced energy consumption is of special interest.

Agrochemical efficiency of liquid fertilizers is given especially by the possibility of better optimization of the plant nutrition. With respect to the basic nutrition — in comparison with solid fertilizer distribution — considerably higher evenness of nutrient distribution is achieved. This results in a significant yield increase. When comparing 164 cases, the mean value of weighed averages of yields of individual crops is higher by 6.4 % in liquid fertilizers (nitrogen). Liquid fertilizers offer a broad spectrum as for the divided and foliage nutrition of plants. The intake of nutrients by foliage enables their prompt incorporation into the circulation of nutrients in plants-without mediating role of the soil-eliminating thus this uncontrollable factor which beyond our influence. This is evident from the data on nutrient utilization by grass growths during a period of 4 years:

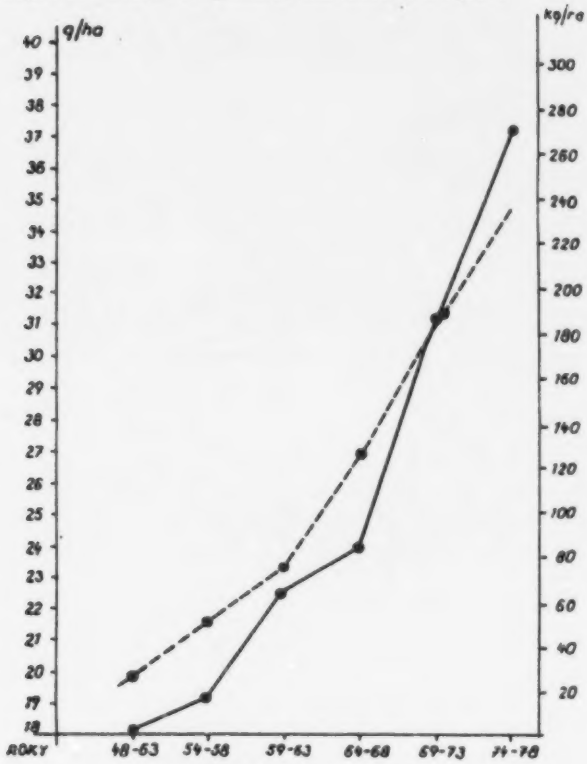
Nutrition	LAV-27	DAM-390	%
Single	129.2	136.8	105.9
Divided	135.7	155.9	114.9

Conclusions of research studies of the Czechoslovak biologists prove unambiguously that a purposeful application of liquid fertilizers highly exceeds the purposeful application of solid fertilizers.

Other advantages of liquid fertilizers

Liquid fertilizers can be applied together with chemical plant protection agents against weeds, diseases and pests. In the USA where the application of liquid fertilizers is the most extensive, as much as 60 % of their volume is combined with pesticides in the works with an intensive utilization of liquid fertilizers.

Dependence of cereal yields on nutrient consumption



——— yields of cereals in q/ha
---------- NPK in kg of pure nutrients per hectare
(1 kg of NPK in p. n. = 7 kg of cereals)

In the conditions of the CSSR, the simultaneous application of liquid fertilizers (DAM-390) and post-emergent herbicides resulted also in an improved weed eradication effect besides the savings of operations in the field; it enables to reduce the doses by as much as 20 %. When considering the pre-harvest chemical drying of crops which is necessary with respect to the mechanical harvesting by joint application of desiccants with DAM-390, as much as 50 % of desiccant is saved.

Liquid form and foliar additional fertilization are recommended as the most rational method for the introduction of trace elements into soil. Intensive crops eliminate from soil not only macronutrients (N, P, K) but also micronutrients and trace elements. Their shortage limits further increases in yields entailing the yield depression of incidence of various diseases (chlorosis, etc.). It seems that the liquid fertilizers can be important economic carriers of the trace elements. The first experiments,

thus far only at a research basis, are very promising. Fertilizers in general are the source of environmental pollution, especially of waters — underground waters by seepages polluted with inorganic salts — nitrates and nitrites, and surface waters by washing off the arable land saturated with industrial fertilizers. Also in this case the liquid fertilizers play a positive role as, because of a very even distribution — they employ to maximum their ability to be bound to the soil complex and prevent thus an excessive pollution of underground waters. In case of surface washing off, the danger of surface water pollution decreases with the application of

divided and foliar plant nutrition. Foliar fertilization of the vegetative growth with a high retention of nutrients in the plant inself takes an important share in the application of liquid fertilizers. At the same time, this is an efficient measure against the erosive washing off of nutrients. This is impossible in solid fertilizers which can reach the plants only through the root system.

What does Slovchémia prepare in the field of liquid fertilizers

Current assortment: nitrogen liquid fertilizer DAM-390 and multicomponent liquid fertilizer of orthophosphate type — Fostim — with a content of nutrients being 8—24—0; this assortment will be enriched by a liquid multicomponent fertilizer of polyphosphate type KVH-PF with a content of pure nutrients being 10—34—0 which is scheduled for the production by the end of the Seventh Five-Year Plan. In the future it will become the main type of the liquid multicomponent fertilizer manufactured by the Slovchémia Trust. Advantages of the multicomponent liquid fertilizer — higher concentration (+12 % of pure nutrients), polyform of P_2O_5 and resulting sequestering ability of the fertilizer as well as the ability to transform the trace elements in soil into the assimilable form, lower retrogradability of P_2O_5 due to which losses of phosphorus are reduced and stable suspensions are easier generated — especially carrier suspensions of the potassium component.

Slovchémia prepares the production of liquid concentrates of trace elements which will be added into liquid fertilizers, especially into the DAM-390 liquid fertilizer. In this way, the trace elements will be applied to that plot where they are required, and in such amounts or combinations as determined by the agronomist according to chemical analyses of soil and plants. Responsibility for dosing the trace elements is thus transfered from the chemical plant to the agricultural one.

In 1980 Chempik Litvínov, design and engineering organization, elaborated a study on the distribution of liquid fertilizers by product pipelines. The project is under examination and the way and possibility of its implementation are looked for. Its employement would result in a considerable reduction of the railway load and supply to all areas would be more flexible.

Industrial fertilizers have become the strongest intensification factor of the plant production. This factor has enabled to increase the yields in the CSSR during the thirty years of the socialist agriculture from 1.8 tons/hectare in 1948—1953 to 3.7 tons/hectare in 1974—1978. When observing the growth in the quantity of industrial fertilizers and the increase in the yields we can see that since the period of 1969—1973 the yield growth rate exceeded that of fertilizers (see Fig. "The dependence of cereal yields on fertilizer consumption").

Production of food is at present of the same importance for a country as its defence ability. There is a great number of agricultural and chemical industry workers participating in the food production. Slovchémia takes a substantial share in the food production in the CSSR with its supplies of industrial fertilizers.

Developmental trends in the production of fertilizers within the Slovchémia Trust can be summarized as follows:
Granulated fertilizers manufactured in the existing capacities should be maintained at the present level of production at the continuous growth of their quality (e. g. classification of further products into the 1st grade of quality) by improving especially their physico-mechanical properties and to make preparations for shipments in bulk ahead of the agricultural sector.

The principal form of industrial fertilizers in the future is the liquid one. Therefore, it is necessary to expand the production of nutrients only in the form of liquid fertilizers and majority of nutrients should be manufactured in liquid form in 1990—2000. It is necessary to focus on the improvement of the quality of liquid fertilizers, increase of concentration and production of completing assortment of liquid fertilizers — concentrates of trace elements and other additives using the perspective liquid form.

CSO: 2020/53

PERSPECTIVE OF LIQUID FERTILIZERS

Bratislava CHEMICAL REVIEW in English Apr 82 pp 9-12

[Article by Ing. Miroslav Kalina, CSc.]

[Text]

Industrial fertilizers are indispensable for the intensification of agricultural production. During thirty years of the socialist agriculture in the CSSR their consumption increased almost 14 times due mainly to the Czechoslovak chemical industry, and in 1980 reached about 250 kg of pure nutrients of nitrogen, phosphorus and potassium per 1 hectare of agricultural land.

This level of fertilization ranges the CSSR among the leading countries of the world.

In 1985 a consumption of 275—280 kg of pure nutrients per hectare of agricultural land is expected to be reached in the CSSR. By 1985 industrial fertilizers will be supplied chiefly in a solid form. Certain amount of fertilizers corresponding approximately to the increase in consumption during the forthcoming period will be supplied in the form of liquid fertilizers. In 1985 the supplies of liquid fertilizers in the CSR should be 11.5 % N and 8.3 % P_2O_5 and those in 1990 are expected to amount to about 20 % N and 15 % P_2O_5.

Liquid fertilizers represent the perspective tendency in the nutrition of plants and fertilization. Therefore, their production and consumption in agriculturally developed countries is continuously increasing. Advantages of liquid fertilizers are evident particularly under the conditions of socialist agricultural large-scale production. The efficiency of liquid fertilizers is equal to that of solid fertilizers. Their main contribution consists, however, in the elimination of hard physical work at handling, uniform incorporation of nutrients into the soil as well as high degree of hygiene and culture of work during the whole process of fertilization.

In the next period liquid fetilizers should play an important role in ensuring the rational system of plant nutrition.

Liquid fetilizers are classified according to the contet of nutrients, physiological effectiveness, corrosive properties, volatility and ammonia content. The best criteria for their classification are ammonia pressure, nutrient concentration and degree of corrosiveness as these properties have the greatest effect on post-production costs. According to the pressure of free ammonia the classification is as follows:

High-pressure liquid fertilizers
This group includes anhydrous ammonia. Although it has been employed in the Czechoslovak agriculture since 1957 its application has not been expanded because of difficulties with transportation and application equipment and demanding safety measures.

Medium and low-pressure liquid fertilizers
This group involves ammoniates (ammonised solutions of ammonium nitrate, urea or their mixtures) which are not used in our agriculture because of their unsuitable properties (strong corrosiveness and necessity of pressure vessels in the post-production operations). Then, the group includes ammonia liquor which is of local importance only.

Pressureless solutions of liquid fertilizers
These are perspective types of liquid fertilizers and their chief representative is the liquid fertilizer DAM-390 manufactured since 1973 in Duslo Šaľa, Natl. Corp. Other manufacturers are Chemopetrol, Concern Enterprise of the North Bohemia Chemical Works Lovosice and East Bohemian Chemical Works Pardubice, Moravian Chemical Works Ostrava and Chemko Strážske.

DAM 390 is an aqueous solution of ammonium nitrate and urea containing in average 30 % of nitrogen of which 7.5 % of saltpeter origin, 7.5 % of ammonia origin and 15 % of amide nitrogen. Its specific weight is 1,300 kg/m^3 which means that 1 m^3 of fertilizers contains 390 kg of nitrogen.

The hitherto foreign and Czechoslovak research studies show that DAM 390 is equivalent to solid nitrogen fertilizers when considering its agrochemical efficiency. The liquid form, however, brings about a number of advantages particularly in the sphere of handling. In fact DAM 390 can be used for basic fertilization, additional fertilization during vegetation, for speeding up decomposition of post-harvest residues, in desiccation of same crops it can replace part of desiccants; it can be used as the nitrogen component for mixing nitrogen-phosphorus or nitrogen-phosphorus-potassium fertilizers as well.

This group includes also the series of single and double component fertilizers, six types of which are manufactured in Chemopetrol, The North Bohemian Chemical Works in Lovosice. The individual types contain nitrogen, phosphorus, pottasium (chloride-free form), calcium and magnesium. The EMPEKASOL series involves:

1. NP-salt containing nitrogen and phosphorus, consisting of ammonium dihydrogen- and hydrogenphosphates.
2. PK-salt containing phosphorus and potassium and consisting of potassium dihydrogen- and hydrogenphosphates.
3. SK-salt containing potassium and sulphur, and consisting of potassium thiosulphate.
4. CK-salt containing potassium and consisting of potassium carbonate.
5. CaN-salt containing nitrogen and calcium and consisting of calcium nitrate.
6. MgN-salt containing nitrogen and magnesium, consisting of magnesium nitrate.

Series of the above liquid fertilizers enables a scientifically controlled plant nutrition with basic nutrients in dependence on their immediate requirements at any ratio according to the inorganic analyses of plants. It is used for additional fertilization of decorative plants and vegetables in greenhouses, grape-vine as well as of some field crops. More detailed data on the properties of these liquid fertilizers are in Table 1.

The group of pressureless liquid fertilizers includes also multicomponent fertilizers with a balanced ratio of nitrogen, phosphorus and potassium, containing also trace elements, eventually magnesium and growth stimulators. These are, e. g. Floran, Harmavit, Lafolany, MKH-18 and Vegaflor: these fertilizers are used for leaf fertilization of different, particularly garden crops and cultures, then for fertilization watering in greenhouses, etc. They are available at retail for private growers.

Pressureless suspension liquid fertilizers

This is a suspension of fine crystals of nutritive salts in their saturated solution, which have a tendency to sediment. These include particularly NP fertilizers of the type 8—24—0 prepared from extraction phosphoric acid. Presently, they are supplied in limited amounts from small production lines installed in Fosfa Poštorná, Natl. Corp. and Chemical Works of J. Dimitrov, Natl. Corp. Bratislava (under the trade mark of Fostim); pilot plant production is being prepared in Chemopetrol, North Bohemian Chemical Works in Lovosice (PENSOL) and

Table 1
Series of the ENPEKASOL liquid fertilizers

Fertilizer	Nutrients g/l min.	Weight $kg.m^{-3}$	Crystallization temperature (°C)
NP-salt	91 N 288 P	1250	− 8
PK-salt	284 P_2O_5 340 K_2O	1480	−21
SK-salt	340 K_2O 237 S	1480	−20
CK-salt	342 K_2O	1380	−28
CaN-salt	120 N 225 CaO	1500	−18
MgN-salt	104 N 133 MgO	1370	−10

a small-scale production is being prepared in the East Bohemian Chemical Works in Pardubice (SYNSOL). Their production depends on the availability of the basic product — phosphoric acid.

NP fertilizers of the type 8—24—0 contain 100 g of N and 300 g of P_2O_5 per liter and are applied either separately or in a mixture with DAM 390 for basic fertilization as well as additional fertilization of different crops during vegetation, particularly in soils with good reserves of potassium and in the systems of reserve fertilization with solid potassium.

In the last years Chemopetrol, Concern Organization Research Institute of Inorganic Chemistry, Ústí nad Labem, paid attention to the preparation of concentrated basic NP suspensions 10—30—0 and 11—33—0 which should replace NP 8—24—0.

This group includes also the nitrogen-calcium suspension known as CANSOL S which has been manufactured by Chemopetrol in the North Bohemian Chemical Works, Lovosice for several years. This solution of calcium nitrate contains min. 8 % of nitrogen and 15 % of calcium (as CaO). CANSOL S is used mostly for fertilization on leaves of various plants grown especially in acid soils.

Introduction of liquid fertilizers into agriculture depends on their manufacture, transportation, storing and application.

As for the manufacture in the CSSR the main problems consist in the lack of raw materials, especially of phosphoric acid, as well as in storing and shipment of final products.

The problems of transportation arise in the supply of raw materials (urea and phosphoric acid) as well as in the shipment of final products. The production and shipment of the series of the ENPEKASOL liquid fertilizers present practically no problems as these are transported mostly in polyethylene containers with a capacity of 600 liters using the customers' means of transport. Also CANSOL S is tranported chiefly by the customers' means of transport. Expansion of the CANSOL S production is limited as in the case of DAM 390 and PENSOL 8-24-0 by sufficient quantities of railway tanks and their prompt return.

The current storing capacity is concentrated chiefly in agrochemical plants and amounts to 32,000 m^3 in the CSR, the largest volume (over 40 %) being in the South-Moravian Region where the development of liquid fertilizer application is ahead. This is followed by the Middle Bohemian Region with almost 20 %, and the least extent of construction is in the West and North Bohemian Regions. The actual storing capacity is somewhat higher, as a number of agricultural plants employ for the liquid fertilizer storing different provisional arrangements (e. g. discarded railway cisterns, fuel tanks, etc.).

The problems of application equipment in the agricultural and particularly in the agrochemical plants are managed satisfactorily. They use car sprinklers Kertitox Global from Hungary and self-moving applicator PAG-7 with the KONAG trailer. This transport and application line with a high capacity is manufactured by Agropodnik Gottwaldov. Airplanes and various adaptations of sprinklers including Kertitox 28/18 installed in the IFA car are also employed.

Finally one can state that the chief problem in the introduction of liquid fertilizers to agriculture consists in the transportation which has negative effects on the production, too (lack of raw materials, restriction of production when the stores of the manufacturer are full); it must be solved together with the Czechoslovak railways and the sector of agriculture. All the existing theoretical konwledge and practical experience justify the gradual increase in the share of liquid fertilizers which are economically advantageous from the aspects of society as a whole.

CSO: 2020/54

RESEARCH, PRODUCTION OF BLOOD PREPARATIONS

Budapest MAGYAR TUDOMANY in Hungarian No 6, Jun 82 pp 467-468

[Text] The program proposals of the National Intermediate-Range Research and Development Plan (OKKFT-Orszagos Kozeptavu Kutatasi es Fejlesztesi Terv) were discussed by the presidium of the academy during its February session.

The Ministry of Health and the academy were entrusted with the task of developing a program to produce diagnostic and therapeutic blood products, that is, to initiate a nationally coordinated research and development activity toward this goal. In the health services and in most branches of medical science, there is an increasing demand for such products throughout the world. Starting to manufacture these products can alleviate nationwide scarcities already during the sixth 5-year plan period and, in addition to considerable savings on imports, it may also yield capitalist exports. The program is designed to involve domestic basic institutes which are already supplying part of the medical-biological products to the nation and which have the basic requirements for research in improved production methods.

Within three subprograms, the program includes 11 research-developmental goals. Among them, the nine goals of the first subprogram have the collective title: "Therapeutic and Diagnostic Blood Products". The second subprogram deals with liposome products, the third with radioactive products, their development and introduction into the health services. The original proposal stresses the openness of the plan; it can be joined at any time by any institution with research and development or product manufacturing activity. One of its goals is precisely to set up coordinated cooperation in the chain of innovations aimed at producing medical-biological products to remedy the basic national scarcities.

The proposal contains detailed specifications for the main events in the subprograms, also including research, developmental and practical-manufacturing projects. Subsequently, it lists the products (ex. therapeutic plasma proteins, aspecific lymphocyte products, radioactive compounds, etc) which can be expected to be produced within the subsequent 5-year plan.

According to the program, considerable achievements can be expected from fulfilling every single subprogram. Thus, among others, we can count on the

production of specific immunoglobulin products and purified leukocyte interferon; the production of transferrin and lactoferrin, and their clinical application; the production of calmodulin from unused blood preparations; the production of hemosome preparations and their use as blood substitutes; the expansion of new in vitro radioimmune assay kits and in vivo diagnostic aids, etc.

Using currently available research and development funds, numerous researchers have been working for a long time in areas belonging to the recommended topics and, based on their training in various specialties, are prepared to perform the research and development as well as the production tasks.

Personnel data on the current production of blood products and other biological products according to the place of research, the number of collaborators having scientific qualifcation and the tools available, and the sources of income to cover operational costs are presented in a separate table. It was also studied how much of the operational costs--according to subprograms--were accepted by the individual institutions, and investments of what order of magnitude are planned by them to obtain the necessary instruments. Part of the instrument and machine purchases require foreign currency; also, new buildings are needed to house animals, preparatory work, storage and refrigeration. The planned functions are an indispensable condition for the fulfillment of every program. Only a minimal personnel increase is required in the research establishments to fulfill the program.

In addition to the preparatory activity which has already been established or which can be established in the research and development facilities, the large pharmaceutical houses such as the United Pharmaceutical and Nutrient Works, the Pharmaceutical Works of Kobanya, the HUMAN and the REANAL will also be in a position to receive and apply the results. The investments needed as a prerequisite for industrial application will be realized in part during the sixth and in part during the seventh 5-year plan period.

According to the proposal, the minister of health would be responsible for carrying out the program. The proposal recommended the establishment of an interportfolio Program Council--according to the guidance principles of OKKFT (National Central Research and Development Council) for the actual guidance--important decisions, supervision of the subprograms and the eventual regrouping of workforces. The council would be supported by a program office for operative guidance. Institutions which have a fundamental role in the accomplishment of the individual subprograms, or where the expertise needed for the topic is available and the previous production method is the most suitable, would be responsible for the individual subprograms.

The rentability of production costs for the preparations planned in the program can only be estimated at this time but it is a positive factor that the "basic material" is secured, expertise gained over many years is already available. Based on a relatively extensive instrument and machine pool and, finally, on excellent international connections, transfer to and domestic acceptance of the most modern methods can be ensured.

The interdisciplinary program involving several portfolios has the goal to establish the scientific basis and high technical standards for the most modern utilization of blood, referred to globally as "red gold". Domestic use of the products--and thereby considerable import savings--will be handled by the health system, and Medimpex will take care of their export.

At the start of the presidial discussion, those submitting propositions reported on the work of the ad hoc committee preparing them. The version judged optimal and presented here was chosen from the three recommendations submitted.

There were 18 comments from invited experts and from members of the presidium. There was agreement that the program is valuable, was prepared by well-founded work, and support for its acceptance was recommended by most speakers.

Some questioned the proportions of the program criticizing the unequal quotas allocated to the subprograms. Many called attention to the importance of international comparison to avoid unnecessary duplications (ex. Czech and Soviet researchers are also studying the expansion of radioactive preparations; in the United States and in Western Europe, they are already using diagnostic tools which were are only planning to do research on).

Some commentators recommended stressing blood plasma and interferon research, viewing interferon production as attractive also in the international context. Others stressed the importance of complexity and the large-scale change in pharmaceutical production expressed by this program insofar as it would also make possible to modernize domestic diagnostic procedures and tools. Some mentioned the possibility of long-range, indirect results, and some formulated the economic issue, the need for market oriented forecasting. Another function of the program was also mentioned which had as its goal the correction of deformities in domestic research, a laudable goal. By realizing the program, for instance, it would become possible to expand more modern pregnancy screening testing. In this field, our backwardness is regrettably great compared to many countries. Currently, 45 irreversibly damaged children are born annually in our country. This could be avoided with the help of radioactive preparations.

A debate developed concerning the appropriateness of expenditures required for the program. Some thought it might be more useful to spend some of the money on starting domestic insulin production. Finally, during the debate, it was declared--as a matter of principle--that health care, and thereby also providing insulin to diabetics, is within the sphere of satisfying basic human necessities, and the possibilities of solving the problem of domestic production of insulin must also be dealt with although this cannot be the task of this particular program.

Contradictory opinions were voiced concerning the extent to which the presidium of the academy can be considered a competent body to decide such totally specialized problems. The opinion appeared most acceptable (and this was also expressed in the presidial summary) that the presidium of the academy is an authentic body with respect to judging scientific up-to-dateness. Currently,

the business aspects of the medical biology program do not fall within the sphere of the presidium. But this body--particularly in cooperation with invited specialists--is responsible to decide the question whether the program contributes to raising the level of domestic medical care.

The presidial resolution stated that the presidium of the academy considers the program suited for a more modern domestic health supply, for raising the level of our scientific attitude and our methodological culture. And also, achievement of the program would become the organizational force in the health services, for instance, the expansion of screening tests.

The presidium recommended correction of the draft at some points and a more detailed elaboration of the financial plans by their authors. Finally, it recommended acceptance of the program by the Committee on Science Policy.

2473
CSO: 2502/90

SELF-SUSTAINING FUND APPROVED FOR COMPUTER TECHNOLOGY APPLICATIONS

Budapest MAGYAR HIRLAP in Hungarian 28 Jul 82 p 7

[Article by Katalin Szikora: "Self-Sustaining Fund; Money for Computer Technology--Obtainable Through Competition"]

[Text] The Central Statistics Office has the state administrative task of central guidance of the applications of computer technology and, as a condition for this, to create good-quality programs. The computer-technology-applications development fund offers an opportunity for this.

The fund was created because there was not a central source of money to carry out these tasks. But the demand was becoming ever more urgent and ever more massive--to provide a sufficient quantity of good-quality operating, applications programs to use on the computers already embracing every area of life. It was also important that the programs not be the results of the individual developmental desires and knowledge of the users, because then their uniform national expansion and further development would have become impossible.

Sober Goals

On the basis of a 1977 resolution of the State Plan Committee the Central Statistics Office--with the support of the interested main authorities--established the computer-technology-applications development fund to finance the central applications development activity for ESZR [Uniform Computer Technology System] machines and to improve software supply. The generation of finances began after 1 January 1978, when it became necessary to pay into the fund a uniform 4 percent for computers of socialist manufacture and the associated expansions (memories, peripherals and remote data processing devices). The fund developed from this, and from the receipts from software trade. Because this provision, tied to a time limit, meant a disadvantage for purchasers of machines after its introduction, they could buy program packages acquired from the fund for less than half price.

But the program is not free. One has to pay to use it, not only because this covers the costs of acquisition but also because the adaptation-developmental work needed for domestic applications also costs money.

By creating the fund, it was intended, primarily, to provide programs for ESZR and MSZR [Minicomputer Technology System] computers, and to advance the considerable financial cover needed to acquire and process systems aiding the development of software. These goals are in harmony with the central computer technology development program also. From the viewpoint of the national economy the task is a three-dimensional one: conversion from traditional data organization to a data base management system, creating possibilities for remote data processing, and aiding the ever growing use of minicomputers.

The computer technology institutions trading in software purchased or developed through the fund also became the owners of the system. The evocative word expresses the essence--the owner undertakes preparations to acquire the program package, carries out its adaptation, and offers various services (installation, maintenance and followup) to those using the programs.

Beginning in January of this year the owner institutions are selected by a competition system, with competitive bids. When judging the applicants, one takes into consideration their computer technology "past" and the level and price at which they undertake to introduce and distribute the program, and when they will pay back into the fund the money made available, together with the interest.

For example, there were three applicants for the owner-institution competition for the SERIES-IV data preparation system. The experts advised that the Computer Technology and Organization Center of the Hungarian Communications Technology Association would be the best owner of the program, because it offered complex services to users at a relatively low price, would begin trading 3 months after takeover, and would repay the costs to the fund in 2 years.

Seventeen Programs

The SZAMALK [Computer Technology Applications Enterprise], which came into being at the beginning of 1982 with the uniting of a number of firms and institutions, became the system owner for a remote data processing software package, also on the basis of a competition. The system has been traded in our homeland since December 1980 and it has more than 30 users, including universities and large enterprises. This general purpose data base management system of American manufacture leads into the future--it manages the data centrally, as members of a single independent file. It can be used well where a number of users need the information at one time, for example, in the production-guidance and product-development work of large enterprises with a number of sites.

Analyzing the experiences of the institutions competing for the office of system owner, it can now be established that program adaptation at one site was a good idea from economic-professional considerations. The owner saves the individual users from the work and costs of adaptation, installation and maintenance. It is a significant foreign-exchange saving that the owner institutions can repay part of the price of the programs with intellectual work.

As for the fund, thus far 17 programs have been purchased and the results justify the existence of a central financial cover. Central acquisition of program packages needed by a number of users is substantially cheaper than if they had been purchased individually by enterprises using computer technology. And since software acquisition and development takes place according to uniform technical viewpoints it helps to develop uniform program systems for ESZR machines, and thus additional costs can be saved.

Eliminated With Time

Uniformization is especially important in the case of programs which operate computers, in the case of so-called basic software, because the applications programs serving to solve concrete tasks are built on these.

The ahcievements of the past period and the current acquisitions and developments will make it possible in the near future to buy programs simultaneously serving the interests of many users from the sales of earlier systems. Thus the fund will become self-sustaining. Thus it can be foreseen that after 1983 the 4 percent surcharge may be eliminated.

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END

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6 October 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 756

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EAST EUROPE REPORT

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ACCOMPLISHMENTS IN BIOMECHANICS RESEARCH OUTLINED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 2 82 pp 86-90

[Article by Prof Khristo Khristov: "The 10th Anniversary of the Creation of the Scientific Group on Biomechanics"]

[Text] Biomechanics is a contemporary science which holds a position between mechanics and biology. It studies the mechanics of motion in animals and man under circumstances of the labor and surrounding environments with a view to meeting the requirements of scientific knowledge and contemporary technical progress in various fields of life.

The interest in biomechanics dates from ancient times but it is only of late that it has developed as an autonomous branch of mechanics with its specific problems and application. The importance of biomechanics is related to its growing application in technology, industry, machine building, transportation, military affairs, aerospace studies, underwater activities in the development of the ocean and the sea shelf, the development of the subsoil, sports, medicine, etc., as well as the use of biomechanical principles of action of biological systems in the development of efficient mechanisms, machines, building structures, anthropomorphic and zoomorphic robots and systems, technical models for sensory systems, etc.

Biomechanics is one of the young scientific research directions of mechanics followed in our country. Its creator and manager is Academician G. Brankov, a noted Bulgarian scientist who is known as the founder of the latest developments in the field of mechanics in our country. A scientist with comprehensive interests, high scientific erudition and great organizational talent, he was the first to raise the question of the overall organized development of biomechanics in our country during the early period of its establishment as a science, when unorganized research on some biomechanical problems existed on a worldwide scale only in a few countries. In 1970 Academician G. Brankov submitted to the management of the BAN [Bulgarian Academy of Sciences] a suggestion with a detailed comprehensive program in the field of biomechanics. In August 1970 the Presidium Bureau considered the program and approved the creation of a scientific group on biomechanics. On 11 June 1971 (Protocol No 8, Point 3) the BAN presidium approved the bureau's decision. A scientific group on biomechanics under the BAN presidium was created, headed by Academician G. Brankov (at that time BAN

corresponding member). The problems which the group was to deal with and the membership of the first problem commission were approved at the same session. This decision marked the historical beginning of the development of biomechanics as a scientific trend in our country. Bulgaria became one of the first countries in the world with an independent academic unit in the field of biomechanics, thus outstripping a number of highly developed capitalist countries. In this respect it was also first among the socialist countries.

The rapid development of biomechanics and the possibilities of its use in our country required the making of further changes in the structure of the new unit. A Central Biomechanics Laboratory was created on 16 October 1972 (Order No 372 of the Council of Ministers Bureau, Point 10 of the addendum), as an independent scientific unit under the BAN presidium, which included a Scientific Group on Biomechanics. Academician G. Brankov was elected director of the new unit.

Starting with 1 July 1977 (Council of Ministers Resolution No 64, Section III, Point 13, Appendix No 2, dated 1 July 1977, DV No 66) the Central Biomechanics Laboratory and the mechanics units of the Institute of Mathematics and Mechanics of the Unified Center of Mathematics and Mechanics became the Institute of Mechanics and Biomechanics (IMB) under the BAN, with Academician G. Brankov as its director.

This was the chronology in the organizational development of biomechanics in our country to this day, starting with the creation of the Scientific Biomechanics Group 10 years ago.

The initial scientific research biomechanics units were problem groups whose basic purpose was to study human systems. Following their transfer to the Institute of Mechanics and Biomechanics, the problem groups became sections which retained their initial systems orientation and research projects--man in his labor environment, as follows: biomechanics of the cardiovascular system; biomechanics of the motor system; biomechanics of the vestibular system; laboratory for the manufacturing of scientific instruments, manipulators and robots; biorheology; electromechanical interaction in biological environments; and others.

Within the IMB system, particularly after undertaking new assignments based on the plans for the development of our country during the Seventh Five-Year Plan, the IMB management had to energize the activities of instrument manufacturing, and, more specifically, bioengineering developments. To this effect, in 1981 (by decision of the BAN presidium, Protocol No 5, Point 2.3, dated 21 May 1981), a Section on Instrument Manufacturing and Robotics with a laboratory for voice relations between man and machine was created on the basis of the facilities of the Laboratory for Scientific Instrument, Manipulator and Robot Manufacturing.

By decision of the Work Group of the BCP Central Committee Secretariat, dated 10 July 1981, the resolution of the Presidium Bureau and BAN Scientific Secretariat (Protocol No 12, Point 1.1.3, dated 17 July 1981) and Letter No 91-BP-28 of 24 August 1981 and Protocol No 26, Point 1.2.1 and Point 1.2.2

of the ETsMM [United Center for Mathematics and Mechanics] Council, dated 11 September 1981, a provisional Problem Group on Prostheses and Anthropomorphic Robots was developed within the IMB. On the basis of the same decisions the Section on Biomechanics of the Motor System was reorganized into the Section on Biomechanics of Motions, Exoskeletals and Manipulators under the IMB, with emphasis on bicengineering.

The development of biomechanical research starting with 1971 and to this day has shown unquestionable progress in terms of topics, scope, scientific ideas, standards and applied signficance. The common features of the topics covered during the past 10 years is that they relate to tasks which are based on reality and are made necessary by the development of technical progress. From the topical viewpoint the studies conducted during that period covered the following areas:

Technology, industry, transportation, construction, etc., which face the "man-operator-machine" problem. Studies are made of mechanical influences on man under normal and extreme pressures, high speeds, pressures created by linear and radial accelerations, hyperbaric loads, mechanical loads of various natures, impact of power flights, optokinetic influences and other factors whose influence defines human behavior in his labor environment and triggers a variety of changes at first to man's health and ability to function;

Bioengineering (instrument and structures), related to the use of the principles of biological systems for the creation of new machines, mechanisms, structures, exoskeletons, manipulators, etc.;

Medicine and medical technology. This involves the use of mechanical-mathematical methods in diagnosis, therapy and prophylaxis; determination of criteria which guarantee the health, life and security of man in his labor environment; problems related to protective means against mechanical influences; problems related to prostheses and artificial organs, mechanical characteristics of organs and tissues, etc.

The assignments formulated in the theses of the 12th BCP Congress were of decisive importance in terms of the direction of biomechanical talks. This applied in particular to problems of automation and mechanization of production processes, replacing unattractive, dangerous and hard physical labor with machines, increasing man's physical strength with exoskeletons, etc.

The application of biomechanics in robotics became particularly topical with the creation of anthropomorphic and zoomorphic robots and manipulator systems which imitate man's movements (for work with dangerous technologies), robot systems for underwater activities, etc.

The specific nature of the tasks set at different stages to the biomechanical units has always required a comprehensive approach to their solution. To a certain extent, this determines the development of the organizational

structure and the personnel. We are currently following the basic biomechanical directions which enable us to engage in serious basic scientific research and applied activities in virtually all areas.

The scientific series "Biomekhanika" [Biomechanics], with Academician G. Brankov as responsible editor, has been published since 1974. This is the first specialized publication of its kind in the socialist countries and among the first in the world. So far 12 booklets, which have been the subject of great interest abroad as well, have been published. They have included a considerable number of articles by noted scientists from the USSR, Poland, Czechoslavakia, the United States, France, Canada, Italy and others. The proceedings of the First National Conference on Biomechanics, which was held in Bulgaria in 1972, were published as a separate collection, in English, in 1973. The proceedings of our national congresses on theoretical and applied mechanics include studies conducted by Bulgarian scientific workers on biomechanics. Bulgarian studies in biomechanics have been published in noted foreign periodicals, collections of symposia, international congresses and others in the USSR, the United States, France, England, Poland, Czechoslovakia and others.

The papers presented by the Central Biomechanics Laboratory at the "Euromech '68" Colloquium on mechanics of solid deformed biological bodies were published in a special collection in English. A collection containing materials from the Franco-Bulgarian seminar on "Biomechanics and Informatics in Functional Cardiological Research" was published in French. In 1978 the first monograph of its kind, both domestically and abroad, on "Osnovni Vuprosi na Biomekhanikata" [Basic Problems of Biomechanics] by Academician G. Brankov was published in 1978. In 1981 the same monograph was published in Russian in the USSR (Mir Publishing House, Moscow). The monograph extensively discusses directions followed in the development of scientific research on human biomechanics. The monograph was rated highly by noted foreign and Bulgarian scientists and specialists.

Ever since it was established in 1971 and to this day, the biomechanic area, thanks to the efforts of its director and the concern of the BAN management and the Unified Center on Mathematics and Mechanics, has engaged in active efforts related to the organization and implementation of scientific measures of national and international nature. The First National Conference on Biomechanics was held in our country in December 1972; the European "Euromech '68" Colloquium (with 53 foreign participants from 11 countries) was held in our country in September 1975; the Franco-Bulgarian "Biomechanics and Informatics in Functional Cardiological Research" was held in September 1978. Our personnel actively participated in national congresses on mechanics in 1973, 1977 and 1981, in the area of biomechanics.

The First Summer School on Biomechanics was held under the guidance of Academician G. Brankov in 1975. It involved the participation of 10 lecturers and 37 students from 8 European and American countries. A summer school on "Biomechanics in Robotics," with the participation of foreign lecturers and students, is being prepared for 1982.

Active bilateral and multilateral cooperation in the field of biomechanics is under way with the academies of sciences of the socialist countries such as the USSR Academy of Sciences Institute on Problems of Mechanics, USSR Academy of Sciences Institute of Machine Building, Latvian SSR Academy of Sciences Institute on Polymer Mechanics, USSR Academy of Sciences Siberian Department Institute of Hydrodynamics, Czechoslovak Academy of Sciences Institute of Hydrodynamics, Czechoslovak Academy of Sciences Institute of Theoretical and Applied Mechanics, Polish Academy of Sciences Institute of Biocybernetics and Bioengineering, and others.

Scientific cooperation is under way with universities and institutes in England, the United States and others. Currently, the IMB is coordinating the topic "Biomechanics" as part of the plan for multilateral cooperation among the academies of sciences of the socialist countries. Cooperation is also under way along the Intercosmos line. Close contacts have been established with scientists in the USSR, Czechoslovakia, Poland, Yugoslavia, Greece, England, France, and others.

The biomechanics personnel maintain close relations with many institutes of the Bulgarian Academy of Sciences, the Medical Academy, the V. I. Lenin Higher Machine-Electrical Engineering Institute in Sofia, and others.

The 10th anniversary of the creation of the Scientific Group on Biomechanics was celebrated in 1981. This was the first scientific research biomechanics unit in our country. It was a period of organizational development and consolidation, personnel development and arrangement of topics, which included the results of meaningful scientific research.

The biomechanical collective at the IMB celebrates with particular pleasure its 10th anniversary, expressing its gratitude to the BAN leadership for its concern for biomechanics and pledges to make its worthy contribution to the implementation of the tasks set by the 12th BCP Congress to Bulgarian science.

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REGULATION GOVERNING SAFE PACKING, TRANSPORTATION OF USED NUCLEAR FUEL

Sofia DURZHAVEN VESTNIK in Bulgarian 24 Aug 82 pp 826-831

[Committee for the peaceful utilization of atomic energy Ordinance No 5 on securing nuclear safety in the transportation of spent nuclear fuel]

[Text] Ministries and other departments

State Committee for Science and Technical Progress

Committee for the Peaceful Utilization of Atomic Energy

Ordinance No 5 on Securing Nuclear Safety in the Transportation of Spent Nuclear Fuel

Chapter 1

General Stipulations

Article 1. The present ordinance defines the technical and organizational requirements governing the securing of nuclear safety in the transportation of spent nuclear fuel.

Article 2. The purpose of ensuring nuclear safety in the transportation of spent nuclear fuel is to prevent the following:

1. The formation of a critical mass;

2. The destruction of the wrapping of the spent nuclear fuel above admissible levels.

Article 3. The ordinance shall not apply in the following cases:

1. Transportation of spent nuclear fuel within the organization in which it used;

2. Transportation of "fresh" nuclear fuel;

3. Radiation safety control.

Article 4. The organizations in charge of transporting spent nuclear fuel shall issue internal regulations ensuring nuclear safety in accordance with the present ordinance.

Chapter 2

Packaging Sets

Article 5. Spent nuclear fuel will be transported in packaging sets type B as per BDS [Bulgarian State Standard] 10473-72.

Article 6. The design of the packaging set must be such as:

1. To exclude the possibility that the spent nuclear fuel may melt;

2. To have a reliable system for hermetic sealing which will prevent its opening accidentally or as a result of pressure which may develop within it;

3. To ensure its firm fastening to the transportation facility during the transportation and its safe shifting with hoisting mechanisms.

Article 7. All systems added to the packaging set in the course of the transportation, which are not part of it, should not affect its safety.

Article 8. Should the packaging set include neutron absorbers, its structure should be such as to provide for the possibility of checking their existence, quality and distribution.

Chapter 3. Packaging

Section I

General Stipulations

Article 9. The packaging sets with the spent nuclear fuel they contain shall be classified as follows from the viewpoint of nuclear safety:

1. Grade 1 packaging--safe from the nuclear viewpoint in a limited number, arbitrarily located and under all possible predictable transportation conditions;

2. Grade 2 packaging--safe from the nuclear viewpoint in a limited number, arbitrarily located and under all possible predictable transportation conditions;

3. Grade 3 packaging--safe from the nuclear viewpoint under all foreseeable transportation conditions because of special precautionary measures taken or as a result of special measures for administrative control during the transportation.

Article 10. The maximum temperature of each accessible surface of the packaging during the transportation of the spent nuclear fuel may not exceed 55°K (82°C) under normal transportation conditions.

Article 11. The maximal effective pressure on the packaging should not exceed 0.7MPa (7 kg-force per square centimeter).

Article 12. In order to exclude the appearance of an uncontrolled change reaction in the transportation of spent nuclear fuel, any given type of packaging must meet one of the following conditions:

1. The mass of fissile materials in the packaging must not exceed the admissible level, i.e., 80 percent of the critical mass of the system under both normal or breakdown transportation conditions;

2. The effective coefficient of neutron multiplication in the packaging must not exceed 0.95 under normal or breakdown transportation conditions.

Article 13. Unless proof can be provided that the melting of the fuel cannot take place, the overall quantity of the fissionable material in the packaging must not exceed the critical mass of the melted fuel.

Section II

Additional Stipulations for Grade 1 Packaging

Article 14. In the case of grade 1 packaging, nuclear safety in transportation is provided by the structure of the packaging set.

Article 15. The packaging structure, based on tests under normal and breakdown transportation conditions, should meet the following stipulations:

1. No water should be able to pass through the packaging if no such penetration is stipulated in the transportation conditions. Should conditions be created for the sifting of water into the packaging, not stipulated in the study on securing nuclear safety, the effective neutron multiplication coefficient must not exceed 0.95;

2. The shape of the content and the geometric shape of the packaging set (taking elastic deformations into considerations), must not change in such a way that the effective neutron multiplication coefficient exceeds 0.95 or the quantity of fissionable substances in the packaging exceeds 80 percent of the critical mass of the system;

3. The following must remain under subcritical conditions:

a) A group of undamaged packaging of the same design, regardless of quantity or location;

b) A group consisting of damaged packaging not to exceed 250 units of the same design, arbitrarily located and surrounded on all sides by a minimal distance of a water reflector. In such cases the existence of a hydrogen-containing delaying factor between the packaging and the penetration of water in the packaging should be taken into consideration should this lead to an increase in the reacting nature of the system.

Article 16. If according to the stipulations of radiation safety the thickness of the wall of the packaging set is equal to or exceeds 0.15m, such packaging shall be considered properly insulated from neutron interaction and, in accordance with Article 15, points 1 and 2, shall be classified as grade 1.

Section III

Additional Stipulations for Grade 2 Packaging

Article 17. Putting together grade 2 packaging in the stipulated area in a quantity larger than the one indicated in the accompanying documentation or certificate is forbidden.

Article 18. The design of the grade 2 packaging must meet the additional requirements stipulated in Article 15, points 1 and 2.

Article 19. (1) In each grade 2 packaging design the admissible number of packagings and groups arbitrarily located in the course of the transportation must be determined as a result of computations or experimentations based on the lowest possible number;

1. One-fifth of the critical number of undamaged packaging, or

2. One-half of the critical number of damaged packaging surrounded on all sides by a minimal distance of a water reflector.

(2) The existence of water-containing delaying agents between the packaging and the penetration of water in the packaging must be taken into consideration should this trigger any increase in the reactivity of the system.

Section IV

Additional Stipulations for Grade 3 Packaging

Article 20. Grade 3 packaging applies to packaging which does not meet in full the stipulations of Section I of the present chapter.

Article 21. Particular safety and control measures must be taken for grade 3 packaging which would prevent dangerous damaging of the packaging under any kind of foreseeable transportation conditions.

Article 22. Combined with the special transportation safety measures, the design of grade 3 packaging must meet the general stipulations on nuclear safety as per article 37.

Article 23. Special transportation measures shall be drawn up specifically for each type of packaging on the basis of a study of deviations from requirements concerning grade 1 and grade 2 packaging. Such measures must include the following:

1. Technical measures which prevent inadmissible damaging of the packaging;

2. Administrative measures which create special transportation conditions which would exclude breakdowns;

3. Efficient control measures regarding the condition of the packaging and its structural components before it has been filled and during the transportation.

Chapter 4

Stipulations Governing Packaging Set Tests

Section I

General Stipulations

Article 24. (1) The packaging set used in transporting spent nuclear fuel must undergo the tests stipulated in Articles 27-31, Section II, and Articles 32-36, Section III.

(2) The tests stipulated in the preceding paragraph may be made in accordance with one of the following methods or combination of methods:

1. Computations (mathematical modeling) of damage caused to a specific packaging set;

2. Tests of models or prototypes of packaging sets.

Article 25. The following must be obtained as a result of tests of packaging sets:

1. Data on possible losses of the material contained in the packaging and the absorbance, the integrity of heat-releasing elements, structural materials, figures on changes in the geometric shapes of the system, dimensions of temporary deformations (tighter packing, bending, etc.) in tests of mechanical strength and sealing of the containers;

2. Data on changes and absorbing agents, heat-release elements and structural materials (integrity, melting, changes in geometric shape) in tests modeling fire conditions;

3. Data on the amount of water which has penetrated into the packaging in tests of dumping the packing in water.

Article 26. A copy of the tests must be added to the packaging set certificate.

Section II

Packaging Set Tests Under Normal Transportation Conditions

Article 27. Packaging set tests under normal transportation conditions must mandatorily include:

1. The pouring of water;

2. Free fall;

3. Pressure;

4. Shock.

Article 28. The water pouring test is considered satisfactory if the following conditions are met:

1. The amount of water per unit of area must equal the amount of water from rain precipitation equaling 0.05 meters per hour;

2. The water must be poured on the sample at a 45 degree angle compared with the horizon;

3. The water must be distributed almost evenly as is the case during natural precipitation along the external surface of the sample, in the direction of the jet;

4. The sample must be placed in a position which presumes the strongest possible effect of the studied details;

5. The sample must be placed in such a way that no water can collect around it.

Article 29. In a free fall test, the sample should be thrown against the target in such a way as to cause the maximally possible damage to the tested safety parts. The height of the free fall, measured from the lowest point of the sample to the upper surface of the target must be no less than 1.2 meters; should the sample weigh in excess of 5,000 kilograms, the fall distance should be no less than the distance indicated in Appendix No 1.

Article 30. The pressure test must include the following:

1. For 24 hours the sample must be subjected to pressure equal to the higher of the following figures:

a) The equivalent of the weight of the actual packaging multiplied by a factor of 5;

b) The equivalent of 13,000 MPa (1,300 kg force per square meter), multiplied by the vertically projected area of the packaging;

2. The patenting must be divided evenly between the two opposite sides of the sample, one of which is considered the base on which the packaging rests.

Article 31. The shop test calls for the sample to be set on a hard flat horizontal surface. A stick 32 millimeters in diameter with a semi-round end, weighing 6 kilograms, must be thrown at the sample from a 1 meter height from the lower end of the stick to the upper surface of the sample. The stick must be thrown vertically in the direction of the center of the most vulnerable part of the samples so that, should it pierce the sample at a sufficient depth it may reach the sealing system as well. The testing rod should not be significantly misshaped.

Section III

Testing the Packaging Set Under Transportation Breakdown Conditions

Article 32. The tests to which the packaging set must be subjected under transportation breakdown conditions must mandatorily include the following:

1. Mechanical damage;

2. Heat;

3. Dumping in water.

Article 33. The mechanical damage test must consist of two falls on targets in such a way as to cause the most severe damage possible on the sample:

1. In the first fall the sample must fall on the target in such a way as to result in maximal damages and the height of the fall from the lowest point of the sample to the upper surface of the target should be 9 meters;

2. In the second fall the sample must fall on the target in such a way as to result in maximal damage and the height of the fall, measured from the presumed area of the strike of the sample to the upper surface of the target equal one meter.

Article 34. The heat test is considered satisfactorily passed when the entire sample is subjected to heat radiation for 30 minutes at a temperature of 1073 K (800 C) with a 0.9 emission coefficient. Following the external heat applied on the sample, the following two conditions must be met:

1. The sample must not be artificially cooled for the next 3 hours;

2. The burning of the material of the sample should not be terminated for the next 3 hours unless it ends sooner by itself.

Article 35. The dumping test calls for the sample to be placed in a depth of no less than 15 meters and be kept there for no less than 8 hours.

Article 36. The stipulation that when dumped in water the sample is located in a depth of no less than 0.9 meters and remain in that position no less than 8 hours in a way in which the maximal penetration of water may be expected applies only to grade 1 and grade 2 packaging in which water penetration increases the reactiveness of the system.

Chapter 5

Transportation Conditions

Article 37. Spent nuclear fuel must be transported in such a way that under regular or irregular transportation conditions no critical states develop and no damage may affect the covering of the heat-releasing elements within a single packaging set or groups of packaging sets. To this effect the following must be taken into consideration:

1. Penetration of water in the packaging set or loss of heat carrier from the packaging set;

2. Reduced efficiency of the absorbing agents installed in the packaging set or neutron inhibitors;

3. Possibility of regrouping the content into systems which can better react both within and outside the packaging set;

4. Reducing the distance between the packaging sets or between their content;

5. Possible increase in reactiveness as a result of changes in the temperature of the content of the packaging set;

6. Other reasons which may result in any damaging of the cover of the heat-releasing elements.

Article 38. If the radiation level of the spent nuclear fuel is unknown and its reactiveness is reduced in combustion, it is considered as non-radiated. Should its reactiveness increase in combustion, it is considered radiated to the highest level. If the degree of radiation of the spent nuclear fuel is known its reactiveness must be assessed.

Article 39. In loading the packaging set with cassettes containing heat-releasing elements, the organization which handles the spent nuclear fuel must:

1. Inform the personnel of the instructions regarding their obligation during the transportation, holding tests to this effect and allowing only those who have passed them successfully to transport the fuels;

2. Test the readiness of all hoisting installations with which the packaging will be lifted;

3. Check the suitability of the transportation facilities which will transport the spent nuclear fuel;

4. Check the seal of all cassettes containing heat-releasing elements to be transported;

5. Check the distribution of neutron absorbers if such are included in the packaging set;

6. Draw up a program for charging the packaging set with cassettes containing heat-releasing elements;

7. Compute the heat for each packaging.

Article 40. After the packaging has been loaded with the cassettes with heat-releasing elements, the organization which manages the spent nuclear fuel must:

1. Establish the parameters of the packaging to the point where a balanced state has been reached;

2. Test and examine the packaging in accordance with the requirements of the operational instruction attached to the packaging;

3. Set up a table indicating the parameters of the packaging as per Appendix No 2;

4. Check the effectiveness of the neutron protection of the packaging, which stipulates the availability of neutron absorbers.

Article 41. The organization managing the spent nuclear fuel must meet the following stipulations in the loading and transportation of the packaging:

1. The packaging sets filled with spent fuel must be reliably fastened in order to prevent the overturning or shifting of the packaging in road turns, pushing, stopping or rocking;

2. The sum total of transportation indicators must not exceed 50 in determining the number of packagings for transportation by rail, truck or water;

3. In the case of sea vessels, the number of packagings must be restricted in such a way that the sum total of transportation indicators per hold must not exceed 50 while the sum total aboard tha vessel does not exceed 200;

4. In the case of sea vessels, if the sum total of transportation indicators per group packages does not exceed 50 and the distance between each group is no less than 6 meters, the sum total of transportation indicators of packagings within a single hold may not exceed 200 without limitations regarding their overall number aboard the same vessel;

5. When the entire hold or deck or entire ship is used by a single shipper, i.e., for the transportation of a full load, the restrictions stipulated in points 2, 3 and 4 no longer apply providing that the number of grade 2 or grade 3 packagings with fissionable substances do not exceed the admissible number.

Article 42. Should the packaging be damaged during the transportation, the transportation may continue after repairs have been completed and the packaging is classified as grade 3. The Committee on the Peaceful Use of Atomic Energy, the Ministry of Public Health and the Committee for the Protection of the Environment must be informed of the accident immediately.

Article 43. (1) Permission for the transportation of spent nuclear fuel is issued on the basis of a written request submitted by the organization managing the fuel, the documentation submitted by it as per Article 44 and a docimetric protocol issued by the organs of the Ministry of Public Health.

(2) The documents stipulated in the preceding paragraph must include the following:

1. A certificate accompanying the documentation on the basis of which it was issued and which contains the following information:

a) Detailed description of the spent nuclear fuel with data on its physical and chemical condition and nature of radiation--a passport of the cassettes containing heat-releasing elements;

b) Detailed description of the structure and the materials of which the packaging is made;

c) Results of conducted tests;

d) Corresponding instructions on utilization and repairs in the use of the packaging;

e) Study of the nuclear safety based on all foreseeable transportation conditions related to the characteristics of the spent nuclear fuel;

f) Special conditions related to ensuring the safe dispersal of the heat released by the packaging;

g) Considerations justifying the selected transportation method and types of transport facilities;

h) A 0.2 x 0.3 meter drawing indicating the structure of the packaging;

2. A protocol certifying that the personnel is familiar with the instructions related to its obligations in the transportation of the spent nuclear fuel;

3. Protocols on the condition and testing of the hoisting equipment used in lifting the packaging;

4. Protocol on the readiness of the transportation facilities used in hauling the spent nuclear fuel;

5. Protocol on the control and tests of the packaging in accordance with the stipulations of the instruction on the use of the packaging;

6. Protocol on the sealing of the cassettes containing heat-releasing elements;

7. Table showing the parameters of the packaging as per Appendix No 2;

8. A chart on the loading of cassettes with heat-releasing elements in the packaging set.

(3) the documents as per point 1 of paragraph 2 shall be submitted to the Committee for the Peaceful Utilization of Atomic Energy 15 days prior to the beginning of the transportation; documents related to the remaining items of paragraph 2 shall be submitted to the inspector on site.

Additional Stipulation

No 1. The meaning of some terms used in the present ordinance shall be the following:

1. In the sense of the present ordinance, "spent nuclear fuel" shall mean fuel cassettes with heat-releasing elements extracted from the reactor following their radiation;

2. "Packaging" shall refer to the packaging set with the spent nuclear fuel within it, ready for transportation;

3. The term "packaging set" shall mean the sum total of components and systems needed for ensuring the safe transportation of the spent nuclear fuel. The set may consist of one or several items, absorbing substances, separating grids, cooling systems, shock absorbers, a system for fastening to the transportation facility, and others;

4. The term "admissible number of packagings" shall mean the maximum number of packagings of grade 2 and grade 3 with spent nuclear fuel, which may be grouped together in the same area of the transportation facility during the transportation process;

5. The term "transportation index (indicator) of the packaging" means:

a) The figure expressing the maximal level of radiation in mber/hour at a distance of 1 meter from the outside surface of the packaging or

b) In grade 2 and grade 3 packagings with fissionable substances, the highest of the following numbers: the number expressing the maximum level of radiation, as stipulated in letter "a" and the number obtained in dividing the admissible number of such packagings by 50;

6. The term "critical mass" is the mass of the spent nuclear fuel at which a fission chain reaction appears;

7. The term "fissionable material" is material which contains fissionable nuclides in the course of the handling of which a fissionable chain reaction may develop.

Final Stipulation

No 2. The present ordinance is issued on the basis of Article 2 of the Ukase on State Control of Nuclear Safety (DV, No 54, 1980) and is binding to all ministries and other departments and organizations.

Chairman: N. Papazov

Appendix No 1 to Article 29

Height of Free Fall in Packaging Weighing Over 5,000 Kilograms

No	Packaging Weight, kg	Height of Free Fall, m
1	From 5,000 to 10,000	0.9
2	From 10,000 to 15,000	0.6
3	15,000 and over	0.3

Appendix No 2 to Article 40, Point 3, and Article 43, Paragraph 2, Point 7

Packaging Parameters

See A, page 830

Key:
1. Number of packaging
2. Estimated sum total packaging activeness
3. Becquerel
4. Computed residual heat release in packaging
5. kvt
6. Temperature of heat carrier in the packaging
7. Pressure of heat carrier in the packaging
8. MPa
9. Maximal depth of combustion in the packaging
10. $\frac{\text{MVt x day}}{\text{kg x U 5}}$
11. Number of cassettes with TOE in the packaging
12. Number
13. Initial enrichment of the spent nuclear fuel
14. Note..pa

Ordinance No 6 on Accounting and Storing Nuclear Material in the Bulgarian People's Republic

Section I

General Stipulations

Article 1. The present ordinance establishes the procedure for accounting and control over the storing of nuclear material in the country, used for peaceful purposes, in accordance with the obligations based on the accord and additional agreement concluded between the Bulgarian People's Republic and the international nuclear energy agency (MAAE) on the application of guarantees related to the Treaty on the Nonproliferation of Nuclear Weapons.

Article 2. The purpose of the accounting and control over the storing of nuclear material is the following:

1. To prevent its use for purposes other than those stipulated;

2. Its prompt discovery and recovery should it be lost;

3. The prevention of radiation risk to the population and the environment.

Article 3. The ordinance does not apply to materials obtained as a result of ore mining and processing activities in the country or nuclear materials crossing the territory of the Bulgarian People's Republic and materials owned by other countries and transported in foreign countries by Bulgarian transport facilities.

Article 4. The organizations which use or store nuclear materials shall formulate internal regulations governing the accounting, storing and control over the movement of nuclear material in accordance with the present ordinance.

Section II

Accounting and Storing of Nuclear Material

Article 5. (1) Organizations which use or store nuclear material temporarily or permanently must:

1. Draw up the following reports:

a) Inventory changes (respectively R.01.1 for receiving and R.01.2 for shipping nuclear material), submitted to the Committee for the peaceful utilization of atomic energy (KMIAE) no later than 20 days after any change has occurred in the inventory quantity of the nuclear material;

b) On the nuclear material on hand in the respective area of the material balance--R.02/c;

c) Material-balance--at the end of the specific accountability period--R.03;

d) Reports as per letters "b" and "c" must be submitted to the KMIAE no later than 20 days following the month during which the physical inventory has been taken;

2. The following books must be kept:

a) Main accounting book in which the movement of nuclear material in the direction of the material balance area and back must be recorded;

b) Fresh fuel book in which the availability of nuclear material in the fresh fuel warehouse is recorded. Such books must be kept for each warehouse separately;

c) Book on the active area of the reactor in which the nuclear material in the active area of each reactor is recorded;

d) Book on spent nuclear fuel in which the movement of the nuclear fuel in the deposit basins is recorded;

e) Inventory book on fuel cassettes by number, type and concentration;

f) Report card on fuel cassette--showing the movement of the nuclear fuel and the specific status and position of each cassette separately;

g) Book on the transportation of the spent nuclear fuel in order to register the nuclear fuel taken out of the country.

(2) Report as per point 1 of paragraph 1 and books as per point 2 of paragraph 1 must be kept for periods of no less than 5 years.

Article 6. Should justifiable grounds exist to the effect that nuclear material may be lost or damaged as a result of unexpected events, in accordance with Article 5 paragraph 1 the organizations must inform their superior organ, the KMIAE and the Ministry of Internal Affairs within 48 hours after the discovery that the material has been lost or damaged or after the possibility of its loss or damaging may arise. The reasons for the incident must be described in a special report in which the measures taken for the prevention of incidents must be indicated. The report must be submitted to the stipulated organs within 15 days following the incident.

Article 7. The organizations which use or store nuclear material must inform the KMIAE and the Ministry of Internal Affairs 15 days in advance in the following cases:

1. Forthcoming planned changes in the available quantities of nuclear material or operations which may bring about any damaging or breaking of the KMIAE or MAAE seal;

2. The transfer of nuclear material to other organizations. In such cases the following information must be supplied:

a) Data on the quantity and composition of the nuclear material;

b) The date and place of packaging and unpackaging of the shipment;

c) The name and address of sender and receiver;

d) Date of sending or receipt of shipment;

3. Stopping the nuclear energy installation for reloading, indicating the planned date at which the installation will be ready for inspection by the MAAE. The permission of the KMIAE and the Ministry of Internal Affairs for closing the active zone must be requested no less than 5 days before the closing down of the area.

Article 8. Organizations which expand nuclear installations they manage must submit expansion data to the KMIAE no less than 6 months prior to the commissioning of the new facilities.

Article 9. Complete physical inventory must be made of the nuclear material in the nuclear installation; their interval and method must be determined by the KMIAE.

Article 10. The organization receiving nuclear material for the first time must coordinate in advance with the KMIAE the means for its accounting and storage control. The information must be submitted to the KMIAE 6 months before the commissioning of the new nuclear installation.

Article 11. The organization which uses or stores nuclear material must assign suitable personnel in charge of accounting and storage of the nuclear material.

Article 12. The officials in charge as per Article 11 must ensure the practical implementation of the obligations on accounting and storing the nuclear material in nuclear installations.

Article 13. Organizations which import or export nuclear materials in quantities exceeding one actual kilogram or which will import or export several individual parcels within a 3-month period, each one of which is under one actual kilogram but the sum total of which exceeds one actual kilogram must submit advance information of this fact to the KMIAE on such transfers no later than 3 weeks prior to the time the parcel has been shipped or received by the nuclear installation. In a combined shipment the deadline must precede the final shipped quantity which will total one actual kilogram. The information must include the data stipulated in Article 7, point 2.

Article 14. In the case of nuclear material exported from the Bulgarian People's Republic to a country in which nuclear material is not subject to MAAE control, the contract must stipulate the obligation of the competent authority of the receiving country to notify the MAAE of the acquisition of nuclear material.

Section III

Nuclear Material Control

Article 15. Overall control of nuclear material in the Bulgarian People's Republic is provided through systematic inspections. The inspections may be internal--conducted by the KMIAE--and international--by the MAAE. The KMIAE inspectors enjoy the privileges stipulated in the Ukase on State Control of Nuclear Safety (DV, No 54, 1980), and the regulation governing its application (DV, No 8, 1981).

Article 16. The MAAE inspectors, approved in accordance with the proper procedure by the competent authorities in the Bulgarian People's Republic shall be given access to the sites to be inspected only if accompanied by a KMIAE inspector.

Article 17. The organizations which use or store nuclear material must assist the KMIAE and MAAE inspectors in their inspections. They must put at their disposal equipment and personnel for measuring the nuclear material, facilities for handling and observing them and the necessary energy to power them.

Article 18. Liaison between the MAAE inspectors and the organizations which use or store nuclear material subject to accounting and moving, shall be provided by a KMIAE inspector.

Additional Stipulation

No 1. The term "nuclear material" in the sense of this ordinance shall apply to:

1. Natural uranium, uranium reduced in terms of isotope 235, thorium and its alloys, and chemical compounds and concentrations of such metals in a physical or chemical form which allows the separation of the fissionable isotope or the production of combustible elements;

2. Plutonium 239, uranium 233, uranium enriched with isotopes 233 and 235, or any other type of materials which may contain one or several of these elements.

Final Stipulation

No 2. The present ordinance is issued on the basis of Articles 3 and 26 of the Regulation on the Application of the Ukase on State Control of Nuclear Safety (DV, No 8, 1981).

Chairman: N. Papazov.

5003
CSO: 2202/19

MICROCOMPUTER SYSTEM SM 50/40-1 (SM 1 265) DESCRIBED

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 3, 1982 pp 275-281

[Article by Vladimir Hanus: "The SM 50/40 (SM 1 625) Microcomputer System"]

[Text] This system represents in practice the series of modules, designs and problem-oriented systems for use in controlling technological processes and terminals within hierarchical systems, for data acquisition and preprocessing, for running administrative routines, etc. The core of the system is an 8-bit microcomputer of small dimensions that can be used either as an independent system or can be built into other equipment. The following modules have already been developed, documented and tested for this compact and low-cost system:

--SM 2138 - a single-board microcomputer, the basic module;

--SM 0440 - a 16K-byte NMOS main memory;

--SM 0449 - a 16K-byte semiconductor EPROM permanent memory;

--SM 2150 - a programmable serial adapter module;

--A nonstandard interface module;

--SM 2151, SM 2152 - external floppy-disk memory controllers;

--An 8-bit analog output module;

--A 12-bit analog output module;

An optically isolated discrete input/output module.

The documentation and testing are being completed (as of yearend 1981) of the following additional modules:

--SM 0441 - a 16K-byte CMOS main memory with reserve battery;

--SM 0442 - a combined memory with 64K bytes NMOS + 16K bytes EPROM;

--SM 2142 - a combined memory with 8K bytes of static RAM + 8K bytes of EPROM;

--SM 2165 - a programmable parallel adapter module;

--SM 2170 - a high-speed mathematical processor module;

--An analog-to-digital converter module;

--A low-level multiplexer module;

--A high-level multiplexer module;

--A counter input module;

--A pulse output module;

--An interrupt input module.

The developed mechanical units permit installation of the microcomputer system's modules in machinery or equipment, in 19-inch bays or racks, or in desk-type or desk-top microcomputer systems.

For direct installation in machinery there is a single or double housing with power supply, cooling fan, space for five or ten modules, and a simple control panel. It is easy to interconnect up to three housings by means of connectors, so as to form a larger configuration. For example, a housing for the 2/3 SMEP [System of Small Electronic Computers] board measuring 280 x 240 mm is used in the architecture of the intelligent CRT terminal (discussed below). For the desk-top model a 19-inch cabinet is used with a designed cover that can accomodate up to 16 modules. A similar enclosure is available for an external floppy-disk memory with two Consul 7112 drives built into a 19-inch cabinet, so that it can be built also into the standard SMEP rack or cabinet or, for the desk-type model, into an ordinary office desk, together with the SM 50/40-1.

One of the variants is the MVS (Microcomputer Development System) as a problem-oriented configuration for the development of programs and applications (see below), based on an intelligent CRT terminal. There is also another configuration variant that can be used for word processing as well.

The SM 2138 basic module contains the following:

--Its own I 8080-based microprocessor that can access up to 64K bytes of memory;

--System bus driver;

--2K-byte static RAM block;

--4K-byte EPROM block;

--Serial interface for one peripheral with an IRPS communication line;

--Parallel interface for one input-output peripheral or for two input or output peripherals;

--Programmable timer;

--Interrupt controller.

With a total of 72 basic instructions one, two or three bytes long, it is possible to address the operands in three modes. The set of instructions is divided into transfer, arithmetic, logical, and branch instructions for the branching of the input, output and store instructions. The average execution time of an instruction is 2 to 8.5 μsec. There is an eight-level basic priority interrupt system. Interrupts are handled by an integrated circuit that generates the priority interrupt vector.

The 16K-byte NMOS-RAM main memory is a dynamic memory with an access time shorter than [number missing] nsec, and a write-and-read cycle shorter than 640 nsec.

The 16K-byte EPROM is a programmable permanent memory for the permanent storage of information. It has an access time shorter than 550 nsec.

The programmable serial adapter module permits connecting four input/output devices to an IRPS or S 2 communication line. In the synchronous or asynchronous mode the program selects the transfer rate which may be up to 9600 bps.

With the nonstandard interface (peripheral interface converter) module it is possible to connect an FS 1501 A/M punched-tape reader, a DT 105 S tape punch, and a Consul 2111 matrix printer.

With the external floppy-disk memory controller it is possible to add a random access memory in the form of twin disk drives, with a total capacity of 512K bytes. It has an output to the I-41 system interface.

The 8-bit analog output module provides for the output of eight separate analog signals into the environment. It converts the microcomputer's digital data into analog signals that are then inputs into the controlled environment.

The 12-bit analog output module is able to send four analog signals of greater precision to the controlled environment.

The optically isolated discrete input/output module permits the input or output of 48 discrete signals into or from the system. In accordance with the number of inputs and outputs, it is possible to select variant A for 24 inputs and 24 outputs, variant B for 32 inputs and 16 outputs, or variant C for 28 inputs and 20 outputs.

The 16K-byte CMOS main memory is a redundant memory for periods of power failure. It has an access time shorter than 950 μsec and a write-and-read cycle shorter than 1.1 μsec.

The 64K-byte NMOS + 16K-byte EPROM combined memory is an autonomous (except for the power supply) universal memory module that permits the recording, storage and reading of data and also the storage of firmware. The RAM part has an access time shorter than 420 nsec, and a write-and-read cycle shorter than 550 nsec.

The EPROM part has an access time shorter than 500 nsec. The combined memory is designed on a single 2/3 SMEP board that replaces four 2/3 boards each with 16K bytes of RAM, and one 2/3 board with 16K bytes of EPROM. This is an advantage in terms of space and power consumption.

The 8K-byte static RAM + 8K-byte EPROM combined memory is similar to the preceding combined memory, except that its capacity is lower. This combined memory has been developed for special applications. Further details are not available as yet.

The programmable parallel adapter module permits connecting up to 72 peripherals by means of a parallel communication line. It contains three programmable parallel circuits that can operate in three different modes. Each circuit contains 24 lines, subdivided into three channels with eight lines each, designated as channels A, B and C. In the 0 mode the first two channels function as either input or output channels, while channel C can be used for four inputs and 4 outputs. The output channels operate with a register; the input channels, without a register. In the 1 mode, two groups of channels are used: an 8-bit data channel (A or B) and a four-bit control channel (1/2 C). Both can be either input or output channels, and both operate with a register. In the 2 mode, channel A is a two-way 8-bit data channel, and channel C is a 5-bit control channel. The data channel has an input and an output register. A combination of the individual modes can be selected during programming. The interrupt module handles 10 interupt requests: 6 from the parallel circuits, 3 external ones from peripherals, and 1 from the timer module that generates signals with pulse widths of 0.5, 1, 2 and 4 msec.

The analog-to-digital converter module permits the rapid and accurate conversion of analog signals from the low- or high-level multiplexer to which it is connected in tandem, into digital code that enters the microprocessor through the bus. A 12-bit converter with a sample and hold amplifier is used. Conversion time is 50 µsec with the high-level multiplexer, and 200 µsec with the low-level multiplexer. Depending on the number of circuit boards used in the multiplexer, the number of inputs can range from 16 to 256.

The low-level multiplexer module makes it possible to connect up to 16 inputs for low-level (low-voltage) signals from various locations in the environment. It passes these signals on to the analog-to-digital converter module for conversion.

The high-level multiplexer module permits the connection of up to 32 inputs for high-level signals from various locations in the environment. It passes these signals on to the analog-to-digital converter module for conversion.

The counter input module evaluates the pulse signals arriving from the environment to the microcomputer, when the information carrier is the number or frequency of the pulses. Its 16-bit counters can be set in advance to input and reset upon overflow, according to four possible modes of operation.

The pulse output module generates at its eight outputs to the environment pulse signals with the programmed number of pulses or with the programmed pulse width. The module contains eight eight-bit counters. It also generates a sign to indicate the nature of the output (increment, decrement).

The interrupt input module receives up to 32 inputs of asynchronous signals from the environment into the microcomputer. These signals require immediate processing and response from the microcomputer.

Possible Configurations

The basis of each configuration is a single or double housing for five or ten modular 2/3 SMEP boards, together with fan and power supply. The power supply is designed in three variants. Type A permits interconnecting the modules in the housing for standard applications and is a part of every configuration (for example, memory modules, programmable adapters, etc.). Type B is intended for interconnecting the modules for communication with the environment. The type C power supply is used in the configuration of the MVS (Microcomputer Development System).

The manufacturer gives the following examples of these configurations:

For data acquisition:

--Housing with type A power supply;

--SM 2138 processor;

--SM 0440 16K-byte RAM module;

--SM 2165 programmable adapter module;

--SM 7202 CRT display with keyboard;

--Nonstandard interface module;

--FS 1501 A/M punched-tape reader;

--DT 105 S tape punch;

--Consul 2111 matrix printer.

For process control:

--Housing with type A power supply;

--Housing with type B power supply;

--SM 2138 processor;

--SM 0449 16K-byte EPROM module;

--Eight-bit analog output module;

--Twelve-bit analog output module;

--Optically isolated discrete input/output module.

MVS for development of applications software:

--SM 1601 simple CRT terminal with keyboard;

--Housing with type A power supply;

--Housing with type C power supply;

--SM 2138 processor;

--SM 0440 16K-byte RAM module;

And either:

--Nonstandard interface module;

--FS 1501 A/M punched-tape reader;

--DT 105 S tape punch;

Or:

--External floppy-disk memory module.

MVS (Microcomputer Development System)

In addition to the mentioned punched-tape and floppy-disk memory versions, the Microcomputer Development System can be equipped also with a 16K-byte EPROM, a circuit emulator and a memory programmer.

The MVE 80 circuit emulator consists of an SM scanning module and a PME emulator processing module. The scanning module records four-bit data for each computer cycle in the course of emulation. It contains circuitry for communication with the system and for interrupting the emulation. The emulator's processor module is based on an I 8080 circuit that during emulation executes the user program's instructions and the instructions of the ROM-stored program for controlling the emulator. It contains circuits for controlling the MVS bus and the user's bus, and it starts and ends emulation.

The PGM 08 simple memory programmer can program the PROM and EPROM memories and read their content. It is designed in a separate cabinet with its logic and power supply, and it is connected to the MVS by means on an IRPR communication cable.

MVS is intended for the development and testing of application programs for systems whose design is based on the I 8080 microprocessor. It permits checking the system, and the programming and copying of EPROM.

Interactive Terminal

The interactive terminal enables the personnel to communicate with the computer system. It is suitable for data acquisition and preprocessing in process control, or as an office or store terminal, and for handling reservations and registrations (for example in passenger transport, hotels), etc. The largest configuration tested included the following:

--A supervisory terminal based on the SM 50/40-1, installed in an alphanumeric CRT terminal with keyboard;

--Three SM 1601 simple monitoring CRT terminals with keyboard;

--A minimum of 32K bytes of RAM;

--An external floppy-disk memory with a capacity of 512K bytes;

--A matrix printer.

To the supervisory terminal it is possible to connect five devices through the IRPS or S 2 serial communication line, and four devices through the IRPR parallel communication line. Of the five serial channels, one is used for communication with the master computer, one for connecting the CRT of the supervisory terminal, and three for connecting the SM 1601 terminals.

Of the parallel channels, one is used for the matrix printer, and the other three can be used for communication with additional peripherals (punched-tape reader, etc.).

Word Processing System

The word processing system is a user-oriented system that does not require any special knowledge of programming microcomputers. It has programs for the complete entry of text that is successively stored in the external memory, without any further intervention. From the external memory the text can be recalled into the main memory, edited and changed, etc. The final text is then printed out on a printer. The text can be printed any number of times and can also be reformated.

The core of the word processing system is the SM 2138 microcomputer, to which the following peripherals are added:

--A standard alphanumeric keyboard (similar to a typewriter keyboard) for entering the text and operating the entire system;

--A visual display unit for displaying the text and the instructions for the user;

--A serial printer for printing the text, with punctuation marks and upper and lower case letters;

--A disk or tape unit for recording and storing the text and for file maintenance in an appropriate external memory.

The system software consists of six basic modules:

--Keyboard utility program;

--Display unit utility program;

--Buffer memory utility program;

--Disk or tape unit utility program;

--Printer utility program;

--Program for guiding the user.

Software for SMEP Microcomputers

The real-time executive routine (ERC) system is the basis for the practical application of the SM 50/40-1 module. It is intended for designing systems operating in real time. It permits the simultaneous processing of several independent tasks on the basis of priorities, the handling of interrupts, and the organization of communication between tasks and between the microcomputer and its

external environment. The tasks may be system tasks for standard operation of the modules, or they can be written by the user for his specific applications. The real-time executive routine requires not quite 2K bytes of ROM and performs the following functions:

--System startup;

--Control and synchronization of the running of the tasks;

--Timing the system;

--Exchange of data within the system.

The DOS MVS operating system is disk-oriented and consists of an entire complex of system programs that are entered in the memory only when needed. For the part that must be permanently entered in the memory, about 12K bytes of memory capacity are required. DOS MVS uses a series of monitor subprograms that must be stored in the memory and require about 2K bytes of EPROM.

The macroassembly program converts the source program, written in symbolic language (assembler), into machine instructions. It can be used with the punched-tape and disk versions.

The PL/M programming language is a higher programming language of the Algol type, for microcomputers. It can also serve as a real-time language. The compiler requires 32K bytes of RAM and a floppy disk, and it operates under DOS MVS. The program in PL/M can be segmented into separate modules, and these can then be assembled for the object program.

The text editor permits the use of all characters of the ASCII keyboard and requires 3.5K bytes of RAM.

The MIKROS microcomputer operating system has been developed for so-called office computer applications. It is simple and independent of the hardware. It permits further operation with add-ons within the framework of the system software and user software. Implementation of MIKROS is feasible in every I 8080-based microcomputer if it has a capacity of at least 20K bytes of RAM.

The MUOS multiuser disk operating system has been developed for the terminal. It permits more efficient utilization of the microcomputer while requiring less than 13K bytes of memory. Besides the macroassembly program, the most important user programs are the text editor, the TL higher-order programming language, and programs for managing disk files. TL language requires 64 K bytes of memory.

L Pascal is a high-level programming language derived from Pascal and adapted for use with the Microcomputer Development System. It is suitable for writing application programs. The compiler's operation is controlled by OS MIKROS. The possible applications will be expanded with the introduction of floating-point arithmetic, structures and standard procedures.

Graphic instructions are being added to P-Basic language. This will permit its use in the SM 50/40-1 system with semigraphic display.

Only deliveries of the punched-tape version are planned from series production in 1982, including 36 SM 50/40-1 and 20 MVS systems. Already 300 systems are expected to be produced in 1983, and 400 in 1984.

MINICOMPUTERS SM 3-20 AND SM 4-20 DESCRIBED

Prague VYBER INFORMACI Z ORGANIZACNI A VYPOCETNI TECHNIKY in Czech No 3, 1982 pp 281-288

[Article: "The SM 3-20 and SM 4-20 Minicomputers Offered in 1982 by the Kancelarske Stroje (Office Machines) Special-Purpose Concern Organization"]

[Text] SM 3-20 Minicomputer Produced by the Namestovo Plant of ZVT [Computer Technology Works], Banska Bystrica

The SM 3-20 is a modern, word-oriented, 3.5-generation minicomputer with a 32K-word semiconductor memory. It is characterized by its modular design, which permits simple and flexible system configurations for the following applications:

--Scientific and engineering computations;

--Data acquisition and subsequent processing, for smaller organizations;

--Applications for physics laboratories and measuring stations;

--Automation of scientific experiments, control of laboratory experiments;

--Applications in education;

--Economic and statistical computations of small volume;

--Applications in agriculture, health care, etc.

The SM 3-20 minicomputer can be used also to write and debug programs for other SMEP [System of Small Electronic Computers] systems (for example, the SM 4-20) with which it is upward compatible, or for an expanded configuration of the SM 3-20 that the user might want in the future.

Basic Hardware Configuration

Designation	Characteristics
SM 3-20	The SM 3-20 minicomputer in the following configuration: --CM 2301 processor, the basic module (including a load module, a simple timer, and all the adapters for connecting the peripherals listed under this item); --A 32K-word semiconductor main memory; --CM 6204 SPTP/3 tape reader/punch module; --CM 5105 disk controller (permits connection of up to four drives for the IZOT 1370 disk cartridge); --CM 5400 disk cartridge drive, 2 x 2.5M bytes, IZOT 1370;

--CM 7202 video monitor with keyboard, screen 25 lines by 80 characters, maximum transfer rate 9600 bps;

--CM 6301 matrix printer DARO 1156;

--CM 5300 tape controller, permits connecting up to four standard tape drives;

--External memory with standard magnetic tape, 9 tracks, 800 bps, length 1200 feet;

--Two standard SMEP racks with power supply, cages, cables, etc.

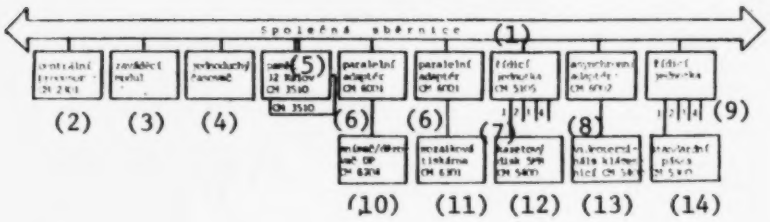

Figure 1. Basic configuration of the SM 3-20.

Key:

1. System bus
2. CM 2301 central processor
3. Load module
4. Simple timer
5. CM 3510 memory 32K words
6. CM 6001 parallel adapter
7. CM 5105 controller
8. CM 6002 asynchronous adapter
9. Controller
10. CM 6204 tape reader/punch
11. CM 6301 matrix printer
12. CM 5400 cartridge disk, 5M bytes
13. CM 5400 [sic] video monitor with keyboard
14. CM 5300 tape controller

The basic hardware configuration of the SM 3-20 minicomputer (Fig. 1) can be expanded by adding the optional modules, with their adapters, listed below. In terms of the number of ports in the system bus and from the viewpoint of the number of interface cards that fit into the cages of the two racks, the configuration may be expanded by adding more than 10 devices, using an extension to the system bus and plugging in additional interface cards. However, only 7 of these 10 additional devices can be used simultaneously (due to the limitations imposed by the operating system).

SM 4-20 Minicomputer Produced by the Namestovo Plant of ZVT, Banska Bystrica

The SM 4-20 is a modern, word-oriented, 3.5-generation minicomputer, the most powerful model in the SMEP I series.

It is fully upward compatible in its software with SM 3-20 minicomputer but has the following advantages over the latter:

--An expanded set of instructions;

--Larger input/output handling capacity;

--A wider range of applications, in view of the 256K-byte main memory and more powerful operating systems.

The SM 4-20 minicomputer is suitable for controlling scientific and engineering experiments and measuring stations, for processing laboratory data, for the acquisition of data from multiterminal systems, for bulk data processing, for continuous and noncontinuous process control, for setting up information systems and managing data banks, for controlling computer networks, etc.

The minicomputer is of modular design, on the building-block principle. Its basis is the system bus to which the processor with the memory, and all other devices, including peripherals, are connected uniformly. Therefore to an installed system it is possible to add later any SMEP module.

Basic Hardware Configuration

Designation	Characteristics
SM 4-20	The SM 4-20 minicomputer in the following configuration: --CPU with 256K-byte memory (includes CM 2401 basic processor, a load module, a floating-point processor, CM 2001 programmable timer, CM 5105 disk controller which permits connection of up to four drives for the CM 5400 disk cartridge, CM 5300 tape controller for up to four magnetic-tape memories, CM 6002 asynchronous adapter for the CM 6002 video monitor, and CM 6001 parallel adapters for the CM 6204 punched-tape peripheral and the CM 6301 printer); --Two CM 5400 disk-cartridge external memories (Bulgarian designation IZOT 1370) with a capacity of 5M bytes each; --CM 5300 standard magnetic-tape memory (IZOT 5004, Bulgaria), 9 tracks, density 32 bits/mm or 800 bpi; --CM 6204 tape reader/punch module (STP/3, Poland), maximum reading rate 500-1000 cps, maximum punching rate 50 cps; --CM 7202 video monitor with keyboard, screen 25 lines by 80 characters or 1920 characters/screen, maximum transfer rate 9600 bps, serial interface; --CM 6301 matrix printer (DARO 1156, East Germany), speed 100 cps, 178 characters per line; --Two standard SMEP racks with power supply and cables.

The basic hardware configuration of the SM 4-20 (Fig. 2) likewise can be expanded with optional modules and appropriate adapters, listed below. In the processor's cage and in the expanding cage of the second rack there are empty slots for the interface cars of the added peripherals that the operating systems are able to support.

Expansion Modules

The following expansion modules will be available, in limited quantities, for the SM 3-20 and SM 4-20 minicomputers:

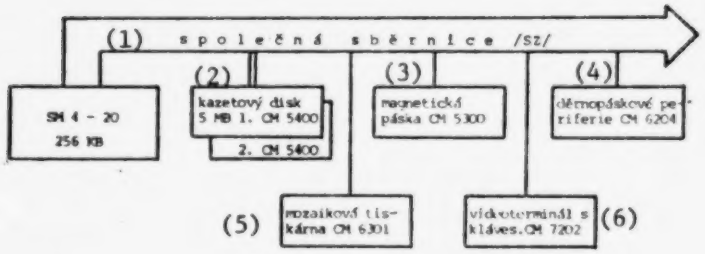

Figure 2. Configuration of the SM 4-20 minicomputer.

Key:

1. System bus
2. CM 5400 cartridge disk, 5M bytes
3. CM 5300 magnetic tape memory
4. CM 6204 punched-tape peripheral
5. CM 6301 matrix printer
6. CM 7202 video monitor with keyboard

Type	Characteristics
CM 7202 serial	Alphanumeric video monitor with keyboard and serial interface
CM 7202 parallel	Alphanumeric video monitor with keyboard and parallel interface
CM 6301	DARO 1156 matrix printer with parallel interface, suitable also for connecting to the CM 7202 video terminal for obtaining hard copy
CM 6204	SPTP/3 tape reader/punch module with parallel interface
CM 6208	CONSUL tape reader/punch module, reading rate 300 cps, punching rate 55 cps, parallel interface
CM 6002	Asynchronous serial adapter ASAD, necessary for connecting serial interfaced equipment to the system bus, either --with four-wire IRPS communication line up to a distance of 500 m, or --before a modem with a CCITT V.24 interface, without any restrictions on distance; for example, over the telephone network (modems MDS 1200 are supplied by ZVT, Banska Bystrica)
CM 6001	PAD-8 parallel adapter for connecting equipment with a parallel interface to the system bus, up to a distance of 15 m
CM 6003	PAD-16 parallel adapter for connecting 16-bit parallel interfaced equipment to the system bus
CM 8105	Zero modem for connecting locally, within a range of several tens to several hundreds of meters, equipment that has a serial interface per CCITT V.24

CM 5400	5M-byte cartridge disk memory (IZOT 1370)
CM 5605	MOMFLEX 6400 (Hungary) external floppy-disk memory with controller and twin drives, total capacity 512K bytes
CM 5300	External standard magnetic-tape memory
EC 6112	ARITMA 2050 punched-tape reader with controller, for SMEP
CM 9004	Controller for connecting JSP-DASIO unit for communication with the environment (JSP-DASIO = CM 9101, supplied by METRA, Blansko)
CM 9205	LJSP laboratory unit for communication with the environment
CM 1601	Simple alphanumeric video terminal, 16 (12) lines, 64 (40) characters per line, serial interface, maximum transfer rate 9600 bps
CM 8606	SAD serial synchronous adapter for synchronous interconnection of SMEP computers or interconnection with JSEP [Unified System of Electronic Computers], transfer rate up to 9600 bps, cyclic code protection, V.24, V.28 interface
CM 4103	System bus repeater for configurations where physical length of the bus exceeds 15 m or the total number of connections to the bus exceeds 18; can be installed to function also as UBM [universal connection unit]
CM 5300	Controller for connecting one to four standard magnetic-tape drives IZOT 5004 (Bulgaria)
CM 0102	Interface for IMS-2 [integrated measuring system], intended for connecting the measuring system's instruments
Expansion cage	Cage for installing the additional interface and adapter cards that do not fit into the processor's card cage
Rack No 168	The SMEP minicomputer rack intended for the insertion of the expansion modules that do not fit into the existing racks; it contains a cage with two universal connection units, power distribution and power supply
Rack No 160	Free-standing rack suitable for housing cages or additional expansion modules (for example, CM 5605, CM 5300, CM 5400)

Software

Software for the SM 3-20 Minicomputer

The described SM 3-20 system comes with the FOBOS-1 operating system, free of charge. It is a two-program or one-program operating system for one user. Languages: Macroassembler, Fortran IV, and Basic. The fee for this basic operating system is included in the price of the hardware.

Also available is the LOS punched-tape system. This is a small operating system for a single user. Languages: Assembler, Basic and Fokal. It contains a number of utility programs, and a set of programs for floating-point operation.

The special-purpose software includes the following:

VU Basic permits the simultaneous operation of up to eight user terminals in a star-connected network, in Basic language.

VYUKA (Instruction) is an operating system that likewise permits simultaneous operation by up to eight users. Its applications are in the field of education.

The PPPD-1 system is intended for the preparation and preprocessing of data from eight operator consoles, with the feasibility of converting the data into EBCDIC code for further processing on JSEP computers. It is supported by the FOBOS operating system on the basis of VU Basic. In the PPPD-1 system it is possible to efficiently prepare and preprocess data by means of the supplied standard software. For special requirements the programs can be modified or written to order.

The PPPD-1 system

--Can be simply adapted to the specific hardware configuration during generation that takes place in the form of a dialogue with the system programmer;

--Is code-protected against unauthorized access;

--Maintains statistics on its own operation;

--Permits the use of various forms, with or without headers;

--Guides the operator during data acquisition, performs a formal check of the correctness of the data, permits work with the headings and regular lines of a form, and stores the data on a disk;

--During the updating of data entered earlier, it can search and find a sentence, edit it, insert new sentences and delete data;

--It can verify data by comparing new entries with original files;

--It can merge batches of data;

--Copies data from the disk onto magnetic tape and converts the ASCII code into EBCDIC code, in a format suitable for processing on individual models of the JESEP computers.

With certain limitations, operating systems intended for more advanced SMEP models may be used on the SM 3-20 minicomputer. These are:

MOS RV V 2, a small multiprogram operating system (the so-called unmapped version) for real-time operation. Languages: Macroassembler and Fortran IV.

DIAMS-1 is an interactive operating system with time-sharing, for several users. Language: Mumps.

For services related to the distribution of the mentioned expansion software (program maintenance, system generation, training of personnel), the user is charged for the costs, in accordance with the regulations that are in force.

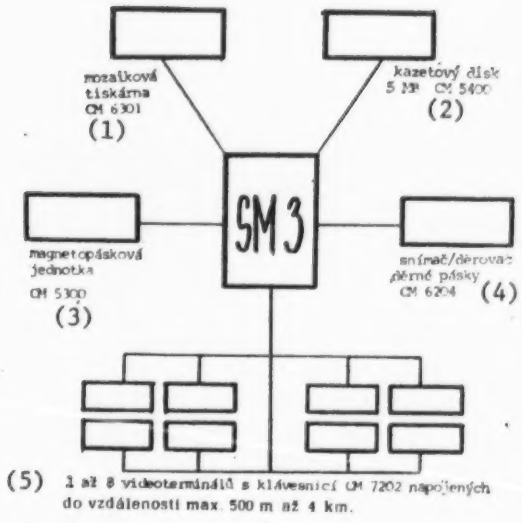

Figure 3. The PPPD-1 System.

Key:

1. CM 6301 matrix printer
2. CM 5400 cartridge disk, 5M bytes
3. CM 5300 magnetic-tape unit
4. CM 6204 tape reader/punch
5. From 1 to eight CM 7202 video terminals with keyboard, connected within a distance of 500 m to 4 km

Software for the SM 4-20 Minicomputer

DOS RV V2 is the standard multiprogram operating system in real time that is supplied with the SM 4-20 minicomputer. The system permits the separate or combined processing in real time of problems that have a high priority, and require fast response to external events, together with less urgent problems of considerable volume, in the time-sharing mode. The method of allocating memory, fast cooperation with the external disk memory, the dynamic compression of memory, and a system of priorities ensure highly efficient processing of the problems. The system is protected against unauthorized access, and the individual files likewise are protected. The maximum number of simultaneous problems is 256.

Languages: Macroassembler, Fortran, Fortran IV, PLUS, Cobol, Basic, and PLUS 2.

The operating system supports also the following special-purpose software:

--RSZ system is a system for managing data and record-oriented files, organized sequentially, randomly or according to the index method;

--DTS is an interactive interrogation system for the handling, selection and printing of record-oriented data;

--SORT is a program for sorting record-oriented files;

--SYRPOS is a system for the management of computer and terminal networks on the basis of an SMEP minicomputer (SM 4-20 or SM 3-20). It ensures communication between the computers and terminals, remote data processing, remote control of the problems, file management, access to remote files, etc.;

--SM GRAF is a set of programs for the developed CM 7405 graphic display terminal, in Fortran language;

--Sets of programs for scientific and engineering computations;

--MTD is a program for creating magnetic tapes in any desired format (JSEP, ANSI, etc.).

The developed DOS RV V2 data base system is not available for the time being.

The operating system, including Macroassembler, Fortran and Basic languages, is being supplied free of charge. The cost of distribution--i.e., of generation, program maintenance, training the personnel, etc.--is included in the price of the hardware. Other languages and special-purpose software are supplied on order, with a charge for distribution.

Other operating systems are:

DIAMS-1 operating system permits the formation of simple data bases and informations systems in the dialogue mode, suitable merely for a limited circle of applications. It has file protection. The maximum number of users is 40. Language: MUMPS.

DOS RVR is an operating system with time-sharing. It is able to process transactions and is suitable for bulk data processing. It also has file protection. The basic mode for up to 24 users is the conversational mode in Basic PLUS, and it may be possible to assemble with this language the problems in Fortran IV and Cobol.

FOBOS-2 is an operating system similar to FOBOS-1, but it is intended for computers that have up to 128K words of memory.

PPPD-2 is available for the acquisition of data from up to 32 terminals, to provide the necessary format, arithmetic and logic control, communication, sorting, printing and conversion functions, to maintain operational statistics, to provide a link to JSEP computers, etc.

These other operating systems will be supplied on special order, for a distribution fee.

The FOBOS, VU BASIC, VYUKA, PPPD-1 operating systems, and the unmapped version of MOS RV V2 (a subset of the aforementioned DOS RV V2) that are intended for the SM 3-20 minicomputer, including all the programs written in them and debugged, can be run also on the SM 4-20 minicomputer.

Documentation

A complete set of the technical and software documentation, numbering scores of titles, is supplied with all the hardware and software.

Deliveries

Similarly as other SMEP systems, the SM 4-20 and SM 3-20 minicomputers are subject to the state material balance. In view of the three-year balancing cycle, computers are being delivered in 1982 that were balanced in 1979, and in 1982 the balance is closing for 1985. The SM 4-20 minicomputers that are to be supplied in 1983 and 1984 have already been allocated from the balance.

In view of the fact that the balance for SM 3-20 minicomputers is not full at present, an additional balance and delivery of this computer can be requested for 1983 and 1984.

Training

The training section of Kancelarske stroje (Zitna 32, 120 000 Prague 2) centrally ensures the necessary training of technicians, programmers and operators for all the supplied hardware and software. After perusal of the schedule of courses offered by this section, the customer may requests forms of obligatory orders for enrollment in the individual courses. The employees are then trained on the basis of these orders.

Installation

Systems are installed on the basis of special orders. The premises in which a system is to be installed must meet the specifications for the construction of computer centers. Since magnetic storage media are used, air conditioning is necessary. The system requires a separate power line that must be grounded ($<4\Omega$).

Warranties

There is an extended warranty of one year on all hardware and software, from the day of the system's acceptance, but not more than 15 months from the date of delivery.

Service

After the warranty period, technical servicing must be performed by the user's personnel. As assistance to ensure servicing by the user, Kancelarske stroje will provide laboratory support to recover damaged disks on an exchange basis, and it will also keep in stock the replacable modules.

Information

The individual professional sections of the appropriate regional office of Kancelarske stroje will provide information on deliveries of hardware and software, on service, and on the construction of computer centers.

1014
CSO: 2402/70

QUANTUM JUMP IN NUCLEAR HIGH TECHNOLOGY DESCRIBED

Warsaw ZYCIE WARSZAWY in Polish 29 Jul 82 p 3

[Article by Bozena Kastory: "A Polish Nuclear Fuel Patent"]

[Text] This is the story of the patent. It is sufficient that the Italians are selling two industrial installations built in accordance with a Polish idea, and the money spent on this work by the IBJ [Institute of Nuclear Research] will be paid back in its entirety over a period of a dozen years or so. It is not that the patent holders received several thousand zlotys each. "The concern is not about money," states Prof Przemyslaw Hoffman, director of IBJ Department XXII. "It is the satisfaction that we can compete with the world's industrial giants. And compete in what? In equipment for nuclear energy, specifically the regeneration of nuclear fuel. They have several dozen nuclear power plants; we have none. When extractors to regenerate nuclear fuel were built at the IBJ, it was necessary to test them under high-activity conditions. But in Poland hot cells were actually eliminated from the investment plans, and it was not possible to check out the extractors."

"Who should we approach? Those who produce nuclear bombs--such as the United States, England or France--do not permit foreigners to participate because of state secrets, military affairs and the like. In the field of nuclear fuel regeneration, the IBJ investigates many subjects jointly with Soviet institutions, but expanding research on extractors was limited by the size of available experimental installations. The smallest extractor developed by the Polish team has a regeneration capacity of 3 kg of nuclear fuel per hour. Is that much? It is very much. The disintegration energy of one gram of uranium-235 isotope corresponds to 1 megawatt-day or 1 million watts for an entire day. That much just from one gram of fissionable material! But the smallest-capacity extractors developed by the IBJ can regenerate 3 kg of spent fuel per hour which contains not 1 but 10 grams of the fissionable uranium-235 isotope and about 6 grams of plutonium-239.

"We began searching abroad for the industrial capability to test our extractors. Two potential candidates, the FRG and Italy, replied. We selected Italy because I first began work in this field in 1967 during my stay of several months in Italy. An agreement was signed between the then existing UEJ [Nuclear Energy Administration] and the National Committee on Nuclear Energy in Italy."

Why do we make equipment to regenerate fuel when we do not have a single nuclear power plant?

First of all, when Professor Hoffman and his people started their work Polish programs projected that Poland's power industry would develop much sooner. In addition, coal resources would not last too long. In the 1990's we will have to obtain energy from uranium. However, by that time the world will be exploiting secondary deposits which are now considered to be unprofitable; such deposits contain no more than 0.1 to 0.2 percent uranium.

In the meantime, in the spent fuel from nuclear power plants about 92 percent of the uranium as well as several grams of plutonium for each kilogram of fuel used is left behind. This is a specific of nuclear reactors as opposed to conventional oil- and coal-fired power plants where all the fuel is burned in one cycle. In a nuclear power plant, 98 percent of the fuel remains in the spent fuel. It should be regenerated, that is, the uranium and plutonium should be separated from the products of fission in order to return the fuel to be burned again. The separated products of fission are radioactive wastes, dangerous to living organisms. They simply cannot be thrown away, thrown into a river or dumped into the ocean. They must be stored in special containers for several years until they cool down, that is, until the short-life radioactive elements decay. Long-life elements will remain at any rate.

Transporting spent fuel to regeneration plants in densely populated Europe is dangerous. It would be best to regenerate them on site. Of course, this is not easy to do. If it were easy, everyone would be doing it now. The very high activity of the spent fuel makes it difficult to extract the uranium and plutonium. Thus it is necessary to conduct operations at a distance, remotely controlled, using completely reliable apparatus because direct human intervention is not possible. One must "breed" robots coupled to electronic brains which could operate within a hot cell, something no living person can do. These robots will have to evaluate the situation, make a diagnosis, make a decision and operate in these cells.

To what extent is the IBJ involved in this work?

"We developed a concept," states Professor Hoffman, "for a two-stage fuel regeneration process. The first, hot stage for regenerating fuel, that is, dissolving it in acid and extractively separating the uranium and plutonium from the products of fission, would be conducted on site at the large electric power plants. Then the uranium and plutonium mixture would be transported to a central plant where the uranium and plutonium would be separated out under international control. Why can they not be used again by the same nuclear power plant? Because they contain plutonium from which nuclear bombs are made. So long as plutonium is mixed with uranium it cannot be bomb material. Plutonium by itself is bomb material.

"At the IBJ we are involved with the first, hot stage of regeneration. We are developing flow-line production equipment, control components and automation equipment. Thus we made the original equipment to dissolve the fuel as well as a whole family of extractors to separate the uranium and plutonium

from the products of fission. The smallest extractor, as already mentioned, has a production capacity of 3 kg of fuel per hour, and the largest has a capacity of 200 kg of fuel per hour. These physically small devices have very large capacities and phase contact time is much shorter then in devices used to date. Thanks to their small size, there is no danger of exceeding the critical mass or of an uncontrolled explosion. Miniaturization of these devices decreases the cost of the very expensive concrete shields. The amount of active solutions in the devices also are decreased greatly, and thus the danger of contaminating the environment in case of failure is also decreased.

"Control is another matter. Ordinarily, the analytic control used in slowly occurring processes proceeds as follows: first, a sample is taken, it is then placed in an analysis chamber where the uranium and plutonium contents are determined. With fast processes, however, this would be only a record of what was, without the possibility of affecting the process. On-line control is needed here. Therefore we developed an on-line control device to determine the uranium and plutonium in solutions before and after extraction. Everything will be automated. Data will be processed with the aid of microprocessors.

"You ask, what projects are near completion? We are on the verge of completing the extractors. An entire battery is ready which will be installed in hot cells in plants in Trisaia, Italy, It will be a test--1,000 hours spent regenerating fuel. After this test, the extractor will become a commercial item. The Trisaia plant is specially designed for such testing. It is very adaptable, it has the capability of modifying specific equipment while in operation. Allowing us into the plant is a great opportunity for us. Our people are being trained in the best plants. But what about our intellectual input? Did you know that the Italians are spending $20 million for this purpose. From our side it is mainly the technology that is worth the money. Tests have already taken place at the Trisaia production flow-line facilities with uranium and thorium. All theoretically possible accidents and how to avoid them as well as a full cycle of investigations were also conducted for the safety report."

The IBJ Department XXII team is the author of the patent. The concept and initial development are Professor Hoffman's. Then came the implementation and improvements. During the course of the project, modifications were made jointly with the Italians. The Polish patented equipment will be jointly patented with the Italians because of the many important modifications. They will be produced in Italy.

Is this better or worse for us?

"We could not manage to do it by ourselves. Many materials needed for production and for operations in hot cells are included in the embargo. Now the Italians are waiting for the arrival of Polish specialists to place the Polish extractors into operation in the Italian hot cells to regenerate spent fuels in the Trisaia plants. With each installation sold by the producer,

5 percent of the proceeds goes to Poland and 5 percent to the Italians. There are willing buyers. There are several such extractors in the world to regenerate fuel. The Polish one is the simplest and thus the most reliable.

"It is not megalomania," states Professor Hoffman. "One cannot learn about equipment, one has to have a feel for it. I was born in a factory. My father also spent his entire life in factories. I have worked with machines for many years. I understand them, have a feeling for them. I am not ashamed to say that machines and equipment are my passion. In the 1950's I directed the team that developed the granulated superphosphate technology. Later, in Tarnobrzeg, we developed the technology for sulfur modification, flotation and smelting. And when work started at the IBJ on applying radioactive isotopes to investigate industrial processes, I was asked to participate in the work. Then I was asked to organize a laboratory which would be involved with nuclear-fuel regeneration. This process requires equipment of the highest technology--it must be reliable and sophisticated, and that is what attracted me."

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END

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28 October 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 758

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28 October 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 758

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OBJECTIVES IN BIOLOGIC, GENETIC RESEARCH

Sofia TRUD in Bulgarian 31 Aug 82 pp 1, 2

[Text] There has hardly been any other scientific field recently which has shown so clearly the connection between fundamental research and its practical application as genetic engineering. Fewer than 15 years have passed from the time when we began to speak about it and the unlimited possibilities which its methods would present to humanity. The research of the complex processes which are at its foundations is a subject of special interest to our scientists too.

Genetic engineering is not an independent scientific field; rather, it is a complex of methods built upon different sciences: chemistry, physics, mathematics, genetics, and molecular biology. In essence, it is the "breaking" (with the help of enzymes of the messenger ribonucleic acid (mRNA) in which process, this complex molecular compound is broken into fragments which opens the possibility for some fragments to "stick" to other, different ones. This is the way to achieve a new biologically active mRNA, and thus the idea about the possibility for the realization of the age-old dream of humanity to correct the heredity of organisms was born. In other words, man will be able to direct heredity!

Of course this is oversimplified, but we can speak about results and certain achievements in the field of genetic engineering on a world scale. For example, the production of insulin and somatotropine hormone from bacteria was helped by the methods of genetic engineering. The same thing happened with the samototropine hormone which helps the building up of biomass in animals and thus leads to an increase of meat production.

Bulgarian scientists from the institute for molecular biology at BAN, under the leadership of Corresponding member Professor Kalcho Markov, managed to construct a strain which produces great quantities of enterotoxins, indispensable for the experimenters. What is the significance of all this?

To explain it, we will remind you that in every human being there are colibacteria, who live there as normal inhabitants, but sometimes they produce toxic substances, called enterotoxins. For nurselings and little children, they create a real danger of severe illness. That is why medical science is trying to produce antibodies, as was done, for example, with the well known

serum for dephteria or snake poison. Unfortunately, the toxic colibacteria produce little enterotoxins and it is impossible to obtain the necessary quantity which is to be purified and sufficient for the creation of antibodies. What is to be done then?

Scientists managed to isolate the gene responsible for the production of enterotoxins and to introduce it in a carrier, the so called plasmid. In essence, it is an RNA molecule which can freely travel from cell to cell and multiplies independently from the multiplying of the cell. As a result, the new strain can produce, by its multiplying, 8 to 10 times more enterotoxins than the colibacteria. It is feasible that new strains, necessary for the creation of other serums, will soon be provided.

The problem of feeding the earth's population, which in 2,000 is expected to reach 6-7 billions, is of paramount importance. Today people speak more frequently about the energy crisis, but it is necessary to remember that 40 percent of the energy resources are spent on the productionof nitrogen fertilizers, so vital for agriculture. At the same time huge amounts of nitrogen remain unutilised in the atmosphere because, as it is well known, plants take their nitrogen from unorganic substances in the soil. Only certain microbes which live in the roots of some leguminous plants can absorb or "fix" the nitrogen from the air.

The problem is complex and very difficult to solve. Experts work in two directions. It seems that it is more realistic to transplant the nitrogen fixing genes from the microbes which live only around the roots of leguminous plants to other microbes which normally develop and live around the roots of other important crops like wheat and corn (there, they will absorb the nitrogen from the air and will enrich the roots with this element).

The other direction is even more fantastic--to transplant these genes directly in the plant! The solution in this case meets with great difficulties since photosynthesis takes place in plants and the oxygen produced in the process destroys the enzyme nitrogenic (the one which is instrumental for nitrogen absorption by microorganisms). However, there are ways for the realization of this almost unbelieveable possibility, and they lie in the genetic changes which will be caused in the plants (or in the microbes).

Scientists do not diminish the purposefulness and perseverance of their work in this very interesting area of biology. They are firmly convinced that the time when the "wonders" of science will come out of the test tube is not far away!

9804
CSO: 2202/20

STATUS OF COMPUTER PRODUCTION CRITICIZED

Prague RUDE PRAVO in Czech 30 Aug 82 p 5

[Article by Zdenek Kotalik, Research Institute of Mechanical Engineering Technology and Economics, Prague: "Following Our Neighbors' Example"]

[Text] Computer technology is one of the fields experiencing the greatest growth worldwide. It is an important fact, under our country's conditions, that it complies fully with the guidelines mapped out by the 16th CPCZ Congress regarding structural changes in production, namely a focus on nonmaterial-intensive production with a high skilled-labor content. It has another special feature. Deliveries of data processing equipment include not only hardware but the means of utilizing it: software, system aids and comprehensive computer utilization plans. This nonmaterial part of the deliveries actually accounts for more than half of the expense of acquiring a computer. There is a need to train capable people and create adequate working conditions for them.

The suitability of the computer field can be demonstrated by a few examples. ZPA [Machinery and Automation Plants] Kosire is producing paper-tape readers, which are peripheral equipment for computers. The devices weigh only 300 kg, but their prices on foreign markets are considerably higher than that of an ordinary automobile. A favorable balance is also provided by Aritma Prague's card-sort machines. Unfortunately we have only a few other types of equipment which would be successful on foreign markets. In contrast, other countries which began developing data processing equipment much later are having greater success in foreign competition: examples are Bulgaria and Hungary.

Reasons for the Shortages

The main reason is our underestimation of the demands of the data processing field, both in the past and at present. The fact that we belong to the small number of advanced countries which are capable of developing data processing equipment should not make us complacent. Our production is scattered and is of the on-off or small-series type. Most computers are produced by enterprises specializing in other fields, so that their production is of an ancillary nature, with low technical standards and inadequate equipment. Naturally this affects quality, costs and the possibility of incorporating the newest achievements of science and technology.

The field suffers from the lack of an adequate overall concept of development. The fact that we have no long-standing tradition of computer production is no excuse. It is precisely because we are really still just beginning that we should proceed in a carefully considered manner with long-range conceptions. Uneven development leads to undesirable duplication in production and an inability to supply a complete range of computers, other hardware and software.

This is the case, for example, in the production of minicomputers. ZPA Cakovice produces the ADT computers, Tesla Straznice the JPR computers, and Zavody vypocetny techniki [Data Processing Equipment Plants] in Bansko Bystrico the SM 3 and SM 4. The SPU 800 processor is also produced there, while the similar AK 10 is made at Aritma Prague. All of the producers turn out their products in small numbers and furnish products with an incomplete set of hardware and software.

Lack of a Full Range of Hardware

The limited overall scope of computer production, together with duplication in the production of mainframes of the same computing power, results in a lack of sufficient capacity for the production of peripherals. Computers are delivered only in the so-called "base configuration," with hollow assurances that the user will later be able to expand the computer to the desired configuration. An incompletely equipped computer can be used at most for experimental or testing work, but it has little potential for practical use.

Disk stores are currently the most acute problem area. Lack of coordination of their development and failure to carry out production and foreign deliveries are the main result of the several years' delay in the production of the 3.5 generation EC 1025 computer. For the most part the producers equip the minicomputers they well with one disk unit, although they are well aware that this incomplete configuration is not usable.

There is an almost complete lack of data collection equipment and terminals to connect computers with management locations. The problem is of many years' standing, even though everyone knows that without this equipment the effectiveness of computers in management is considerably lessened. No producers have come forward even though the wholesale prices of existing equipment, such as the terminals for the KA 10 computer and displays, are very attractive and these products are suitable export items.

Computer reliability is still an important problem. Even though it has improved considerably, the steps that have been taken cannot be considered sufficient.

Another reason is that computer malfunctions in the control of production and manufacturing processes may cause considerable loss. The situation is aggravated by a shortage of terminals and of communication and control components for automation equipment. These components are frequently replaced by equipment developed in-house, which increases the malfunction rates of the entire systems.

The unavailability of complete computer configurations and concern about their frequent malfunctions are making users cautious in selecting the roles to be turned over to computers. Frequently the criterion used is not the effectiveness of the role that the computer might play, but the question of what can be done by an incompletely configured computer and the question of how great a threat to operations is posed by computer malfunctions. Thus preference is given to roles which are not very critical or very important for supporting the functioning of the organization.

The Solution

We need not look far for a model. Our neighbor to the north, East Germany, has built a powerful, prosperous production base, which is has concentrated in one economic production unit with its own research base, industrial technology base and export organization.

We are clearly not capable of building such extensive capacities. Rather, we need a well-considered concept for the long-term development of the field. We must start with the recognition that we cannot develop and produce everything ourselves. Our means of dealing with this problem is our inclusion in the international division of labor among the CEMA countries. We must be actively involved, in keeping with our capabilities and needs, and our involvement must allow us to achieve mass production. It must lead to renovation of export capabilities in the field and thus produce foreign exchange for import of the equipment which we need to complement our own products and fill out the required selection.

The adoption and consistent implementation of such a concept must eliminate duplication in the development and production of computers and lead to the institution of new, considerably more stringent demands regarding the quality of data processing products. We must see to the expansion of organizational and technical assistance so that comprehensive service can be offered with deliveries and installation of computers and so that a high level of functional capability can be maintained and effective assistance in planning and programming for the equipment can be assured.

8480
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PRODUCTION AT COMPUTER TECHNOLOGY PLANT DESCRIBED

Bratislava PRACA in Slovak 18 Sep 82 p 9

[Article by Juraj Sidorenko: "SMEP Is Born Here"; at Computer Manufacturer in Banska Bystrice]

[Text] When it is said that the Computer Technology Factories have been in Banska Bystrice since 1 January 1979, it is true--but not completely true.

"Because," explains their long-range technical development plan manager, Eng Josef Cuchran, "our enterprise has been here longer, but previously we belonged to Tesla. The objective of the change has been to create improved conditions for the development and application of computer technology by concentrating the research, production and delivery functions."

Previously, computer technology was being worked on by organizations and enterprises belonging to several VHJ [Economic Production Units]. As of January 1979, however, they were all placed under a single, umbrella concern organization, the Prague Automation and Computer Technology Plants.

"The concern includes three research institutes: the Zilina Computer Technology Institute, the Prague Mathematical Machines Research Institute, and the Prague Research Institute for Automated Equipment. Our firm, in conjunction with our factories in Namestovo, Rimavska Sobota and our separate operations in Hel'pa and Zeleznа Breznice, cooperates closely with the Zilinia Computer Technology Institute in particular."

First was the SPU 800

The former Tesla factory at Banska Bystrice originally built equipment for the reception and selection of television and radio signals, telecommunications equipment, components and parts for the electrotechnical industry and, finally, information-processing equipment.

"And it is this last phase, which began to develop intensively here in the mid-seventies, that became the basis for what is now our central program and, to be sure, the reason that our factory is included among those involved in computer technology. Back in 1977-78 the first deliveries were made of the first, for its given area of application, the Czechoslovak microcomputer system,

"the SPU 800. Just as at the former Tesla factory in Namestovo, so today in our factory we have been producing the first minicomputer control system, the RPP 16."

On this basis, then, they have begun to build a new future. Now their main development and manufacturing program is in Sector 403--Information Processing Machinery. This equipment accounts for two-thirds of their output and this percentage is expected to increase, because the remaining three fields, hold-overs from the Tesla period, are not developing within the firm. All growth is concentrated in information processing and its supporting divisions.

For Control Automation

We will not go into the reasons why microelectronics have assumed such a priority position throughout the world. These reasons are known, convincing and are generally recognized. At the Banska Bystrice Computer Technology Plants concern enterprise and its factories, the above-mentioned two-thirds of total output devoted to computer technology is represented this year primarily by the SM 3/20, SM 4/20, and SPU 800 minicomputer systems and by several types of peripheral equipment.

We have said that these factories cooperate closely with the Zilina Computer Technology Research Institute. This institute is the center for research and development of the SMEP micro- and minicomputers (System of Small Electronic Computers), while the factories will handle the production. They are now producing the equipment for the initial SMEP series, the SM 3/20 and SM 4/20, which were mentioned above.

"These machines are used primarily in ASR, automated control systems for technical processes, for enterprises, in the field of scientific calculations, and in the automation of design and construction work.

"The future development of the SMEP mini- and microcomputers will be undertaken in conjunction with the Technical Cybernetics Institute of the Slovak Academy of Sciences in Bratislava as well as with the following, mainly college level facilities: the Electrotechnical Faculty at the Slovak Institute of Technology in Bratislava, the Kosice Institute of Technology, and the Czech Institute of Technology in Prague."

Expanding Applications

"The SMEP I is already being succeeded by the SMEP II, which will be compatible with the first system both in terms of technology and in terms of software.

"The SMEP II series includes the production of new equipment: the SM 50/40-1 and the SM 50/50 microcomputer systems, the SM 52/11 advanced minicomputer system, and the SM 53/10 distributed, multicomputer system.

"This implies an expansion of applications, mainly into the field of technical process-control. Microcomputers will be used here not only to control

"entire systems but also individual machines or smaller technology, industrial robots and handling equipment. (Regarding the latter we are in close contact with the Metal Industry Research Institute, VUKOV in Presov, which is coordinating the development of our robots and handling equipment.) By the same token, however, this computer technology may be applied to the preparation, processing and transmission of data."

Production of the SM 50/40-1 will begin this year, and next year production will begin on the remaining members of the SMEP series.

Work is Proceeding on SMEP III

It is essential, however, to think much further ahead than a single year, to the end of the 5-year plan. Attention must rather be directed to the upcoming 5-year plan, and therefore the SMEP III series is already being prepared by the professional research and development base. This is a matter of designing of mini- and microcomputer systems which will be used at various levels of control and automation, but primarily in those areas where their introduction will produce the most significant technicoeconomic impact. These fields include the machinery industry, with consequences for the fuel and energy sphere, agriculture, as well as chemistry, health care and other sectors. Research and development work is to take place in the current 5-year plan, with production and installation planned for the next 5-year plan.

Peripherals as Well

However, their development program in Sector 403 includes not only the systems themselves, but also selected types of peripheral equipment for the SMEP and the JSEP (Uniform System of Electronic Computers). The CEMA produces computers of this series in our country primarily at the Cakovice Machinery and Automation Plants, which in turn are part of the Automation and Computer Technology Plants concern enterprise. This series is made up of larger computers designed for the processing of large volumes of data.

"Peripheral types of equipment we are currently producing include the EC 7934-00.01 electronic printer, the EC 7925 display for the Czechoslovak EC 1026 computer for export to the USSR, display units for the SPU 800 system, and mode modems for data transmission (the word modem is an acronym composed of the first letters of the words modulator and demodulator and is a piece of equipment that modifies signals so that data may be transmitted by a unified telecommunications system). We are also producing PAS 465 input units which convert graphic representations into electrical signals. This is the current situation, and by way of explanation one should add that the units designated by the letters EC belong to the JSEP series, and those designated with SM belong to the SMEP series. In developing our products for the JSEP series we are primarily in contact with the Research Institute for Mathematical Machinery which is focusing its work on the scientific and technical development for the JSEP program."

Future plans for the development of peripheral equipment at the Banska Bystrice Computer Technology Factories include the further development of displays

(graphic, black and white, and color), work station terminals based on the SMEP microcomputers, external memory based on magnetic media for mini- and microcomputers, and keyboards.

Construction Components

The production of construction elements is also being developed at plants of Sector 374, Construction Components for the Electronics Industry. This includes the production of printed circuits with the possible transition to multiwire communications and the production of microswitches. There is also Sector 373, Associated Microelectronic Components. This heading includes the ongoing and expanding production of hybrid integrated circuits of simple structure with a gradual transition to integrated microprocessor structures.

"This extensive change in the production program of the firm also influences the technology of production processes, especially in the area of the reconditioning and testing of used components, but primarily in the testing of the computer equipment which is being produced. Even this testing apparatus is controlled today by mini- and microcomputers. And we are also producing some of this equipment for other users, and this part of our production will also grow."

The Component Base

And finally, we asked Eng Josef Cuchran, who is responsible for long-range technical development planning at our single producer of the SMEP mini- and microcomputers, to what extent they are capable of covering the needs of our national economy for their products.

"We have the production capacity to satisfy them fully. It is true, though that this production is limited by the availability of peripheral equipment, imports of certain components from foreign currency areas and, over the longer term, also by the degree of rationalization and modernization of production technology."

And how successful are we being in approaching the standards of state-of-the-art production worldwide?

"If we are to produce state-of-the-art final products, we must have at our disposal components with this level of technical sophistication and price. As far as function is concerned, we are able to manufacture good equipment, but it is heavier, uses more energy, takes up more space and requires greater amounts of service. And since we are concerned with conserving materials, energy and people, all of the above must be evaluated negatively. This follows from the criteria for evaluating the technical sophistication of products, which determines possibilities for export. Moreover, the sophistication of the component and material base available to us for computer technology also exerts a fundamental influence on this. We must, therefore, import certain components even though we are attempting gradually to reduce imports to the lowest possible level. We must consider it a success that under these conditions the technical sophistication of the SM 3/20 and the SM 4/20 minicomputers has been recognized. We are now trying to win recognition of the technical sophistication of the equipment we will begin producing this year and next."

9276
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HIGHLIGHTS OF ACADEMY RESEARCH FROM 1976-1980

Budapest MAGYAR TUDOMANY in Hungarian No 6, Jun 82 pp 441-462

[Article by Lenard Pal, first secretary of the Hungarian Academy of Sciences (MTA): "About the Academy's Research in Recent Years, 1976 to 1980"*]

[Text] Introductory Thoughts

An old and honorable tradition in our academy is that every 5 years the general secretary delivers to the general meeting a comprehensive review of the state of the academy's scientific research and acknowledges the work of the research centers cooperating in practicing the various scientific branches. However, these acknowledgments worded with precise care and the mild and circumspect criticisms heard once in a great while--understandably--generally leave only quickly fading impressions in the audience, particularly in those removed from the particular specialized area. Because of their necessary brevity, these acknowledgments cannot actually characterize the achievements.

Here, at the highest forum of our academy, it is justified to hold an exchange of ideas with a broader outlook concerning implemented or missed opportunities, results and shortcomings. We cannot isolate our work from the social, economic and cultural processes of the present era; we can study our work only in that context, while analyzing the multifaceted manifestations of the mutual effects. It used to be said that generally the past is worth dealing with only to the extent necessary to help judge more accurately the present, and to outline more carefully the tasks of the future. There is great truth in this but perhaps more is involved here: continuity and definition, to which the key of understanding is provided by examination of the past.

Looking at the past 5 years I would like to concentrate my remarks on the following issues--without aiming at completeness:

--How good was the contact between academic research and the domestic socio-economic reality?

--What results were produced?

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*We are publishing the full text of the general secretary's report. At the 7 May closed session of the general meeting, this report was delivered in an abbreviated form.

--How much did academic research cost?

--How well did we make use of the opportunities in international sharing of the work?

--How well did we direct the research effort?

Obviously my answers will be one-sided. I hope that the debate will provide a significant contribution to help us see the main characteristics of the recent era's work from more angles. This in turn will certainly help draw the right conclusions for future tasks.

Before I turn to the individual issues, I would like to call attention to a few well-known facts. The world economic crisis further deepened from 1975 to 1980; the unfavorable tendencies, which could even be seen from the experiences of earlier years, gained strength. The thawing process in world politics has stalled. A situation that in many respects requires new initiatives in order for a new thawing process to develop has developed.

The unfavorable tendencies in the domestic economy also gained strength during this period. Domestic consumption of the national income did not exceed the development of resources by the desirable margin. The foreign trade deficit increased. Based on the December 1978 resolution of the MSZMP Central Committee, it became necessary to look for and develop new paths of growth, taking care that domestic consumption increase more moderately than the national income, that the foreign trade balance improve and that simultaneously the average standard of living should not deteriorate.

It is well known that in 1977 the Politburo reviewed the experiences of implementing the scientific policy guidelines. It concluded that even though the effect of the guidelines is recognized in the basic processes, significant shortcomings can be seen in a number of important areas. We did not succeed in significantly concentrating the intellectual and financial resources on the most important tasks and we did not succeed in identifying the research areas to be increased or cut back. Critical evaluation of the scientific performances is insufficient, joint interest of the researchers and users in the utilization of research results has not developed, etc. The resolution paid much attention to the factors that promote and hinder society's use of the results of science and technological development, since the analyses showed that progress was slower than desirable in this area and unfortunately slower than possible. The resolution concluded, for example, that some production organizations are still afraid of the risk associated with the introduction of the scientific results.

What Were We Doing?

It is not easy to answer the question of how academic research reacted to the experienced and expected changes in the socioeconomic reality and to what extent it successfully implemented those social and economic priorities in the modification of the plans, which were worded more and more strongly through this period. Essentially, even though the scientific research and direction did react to the changes, unfortunately it did so timidly and with significant

inertia. This general opinion does not mean that there were no noteworthy and successful initiatives in some areas; it merely indicates that these initiatives did not become general. When I speak about the academy's research, I am referring not only to research conducted in the research institutions but also to research conducted in universities aided by the academy and other research conducted in other frameworks.

Among these good examples several social science research projects began; these were initiated primarily by the changed circumstances. Among these, it is worth mentioning the research projects dealing with:

--the problems of transition to intensive reproduction;

--the role of domestic natural resources in shaping the production structure over the long range; and

--comparative analysis of the economic growth indexes of the CEMA countries.

The National Long-Range Scientific Research Plan was also expanded with three new main directions in the late 1970's under the effect of the changed circumstances. These main directions are:

--"Establishing scientific basis for the further development of our economic policy";

--"Comprehensive scientific study of the country's natural energy resources"; and

--"Development of social structure, life style and conscience in Hungary."

The natural science and technological research institutions also endeavored to have the priorities demanded by the new situation prevail in their research tasks. Such initiatives appeared in the larger research institutions as well as in the smaller research facilities. In the second half of the last 5-year period the goals reinforcing the technological-economic orientation began to have an increasingly vigorous effect in the academy's research.

The research facilities paid increased attention to

--development of scientific foundations of technologies that serve to decrease the specific energy and raw material requirements;

--the methods serving economical production, quality improvements and rational consumption of the basic and structural materials;

--advancement of automation and computerization;

--strengthening of the scientific background of the food industry; and

--the scientific foundations of further development of the economic policy and of preparing the comprehensive political and national decisions.

Improvement could be seen in use of research results in the national economy but unfortunately a breakthrough did not occur--due to the combined effect of several circumstances. A number of important results will be recorded in the history of Hungarian technological progress as missed opportunities. For example, the Hungarian result in the production of leaf-protein was not successfully converted to economic profit. Even the Soviet Union finally contracted with the Alfa-Laval firm, not with a Hungarian enterprise, for the delivery of a leaf-protein plant. The magnetic bubble memory, developed in this country, did not find its way to the users; its technological level has even provoked Mr Carlucci, the U.S. deputy secretary of defense, to make unfounded charges against a noted Hungarian researcher. Our researchers have developed the production technology of some special materials (single crystals) important in electronics; unfortunately no entrepreneurs have been found to produce these materials. Utilization of several innovations in laser technology also did not take place; several potential pharmaceuticals and active agents for plant protection chemicals did not get beyond the laboratories.

Much has been written and much debate has taken place in the country about the utilization of technological and scientific results. Depending on where the debate took place, sometimes the research and development sphere and sometimes the production and sales organizations were blamed. However, if we carefully evaluate the experience gained in the last 5 years, we can conclude that the unfavorable phenomena were not caused by chance and generally not by subjective ill will. The unfavorable phenomena appeared more or less as the logical consequence of that system of conditions into which the research-development and production-sales organizations were embedded and in which they were forced to conduct their activities. Without going into the details, I would like to note only this much: experience shows that conditions that reflect the real value and interest relationships favor the utilization of research results more than do blaming and directive-issuing. Even with favorable conditions Hungarian-sized production and sales organizations alone cannot accept the full risk of introducing results that promise profits only over the long range.

It is well known that the social, economic and other effects of scientific results do not appear immediately. Therefore the effects from research between 1976 and 1980 and the consequences of initiatives and undertakings can be reported meritoriously also only after a few years.

However, according to our studies in the period under discussion the majority of the academy's research locations tried to react correctly to the changed circumstances. The information as well as the business contacts with the enterprises became livelier and stronger; the activity of the research locations increased in quickly and effectively transfering the specialized knowledge and advanced training of the professionals and in spreading the scientific methods and way of thinking. Planning became more flexible and adaptive. Several research centers carried out significant modifications in their research plans in the interest of satisfying the new needs. In a word, the connection between scientific research and social reality became stronger.

However, by listing these favorable facts I do not intend to weaken the conclusion that in the economically better years of the 1970's we did not succeed

in taking significant steps in social respects to break down the dividing walls between research and development, and production and sales, or to promote acceleration of innovation and technological growth. Thus, this task carried over to the first half of the 1980's. A situation has developed in which the domestic research policy has to face two requirements at the same time. On the one hand, it must vigorously develop the innovations that bring actual economic profit; on the other hand, it must intensively support the basic research projects that provide the new scientific information, under much more unfavorable economic circumstances than before.

Actually we started to solve the first part of this dual task in 1978, when development of the medium-range research and development plans began on the basis of the Politburo's resolution. The bodies and institutions of the Hungarian Academy of Sciences did their share of this work; it is no exaggeration to interpret this as correctly reacting to the changed circumstances.

For a few years the work on the medium-range research and development programs, which also included the need of practical realization, appeared to divert attention from the basic research projects, from development work that serves the more distant future, even though neither the people working on them nor the ones directing the work had such intentions. To the contrary, state and party resolutions called special attention to the importance of basic research. But in the early 1980's it again became necessary to clarify that even a small country like ours has an absolute need for high-quality basic research that produces new information, if the country wants to stand its ground in international competition.

The expenses of basic research activity between 1976 and 1980 amounted to about 47 percent of the academy's total research expenses, in contrast with 53 percent in the previous period. These numbers are not accurate but illustrate the tendency well. Actually it is not even so much the approximately 6 percent decrease that causes concern, as the deterioration of those financial conditions necessary to basic research. Because of the insufficient budgetary resources in the last time period, regrettably the financial supply to basic research has deteriorated, which in turn limited exploitation of the intellectual potential.

The conclusion can be drawn from the international trends and processes that during the 1980's the countries of the world--including our country--will need qualitatively new results in order to find the new growth paths, to create the means indispensable to build up these new paths, to avoid or limit those unfavorable effects that may occur as unforeseen consequences of past growth.

Everything indicates that the present characteristics make it necessary to increase support to high-quality basic research, which creates new things, since it will be possible to fend off a number of unfavorable effects only if we intervene on time, with the appropriate scientific thoroughness and with new methods in the processes that cause them. Basic research provides the basis for this. Domestic scientific opinion has several times expressed its desire to increase the share for successful basic research of the sums planned for research and development.

I would like to speak separately about some general characteristics of the activities of the social science research facilities, about the nature of their reacting ability produced by the socioeconomic reality. Differences can be seen between the individual specialty areas in the success of the activity as well as as in the nature of the reacting ability. For example, our researchers have unquestionably achieved outstanding results recognized not only by our country but also all over the world in research areas in economics, world economy, sociology, history, psychology, etc., even though the intensity of dealing with the questions presented by practical life was not free of fluctuations even in these areas with outstanding research results. In some scientific areas a certain reserve was seen from the present problems of reality [sic]. Of course, we must value highly all scientific production, regardless of whether its results can be utilized directly; this conclusion is valid also for the research projects of social science. However, if in some areas withdrawing from the socioeconomic priorities or contrasting these priorities with the requirements of being scientific becomes noticeable, then by all means this presents a reason for concern; this behavior indicates a failure to recognize something important, or perhaps a conscious refusal to accept it. Unfortunately such behavior can be experienced at times in almost all research facilities, including the non-social science research facilities; this often manifests itself in the demand that the authorizing parties provide additional manpower and additional financial support for the new assignments. Often the idea that the new assignments should replace some unsuccessful old research project does not occur to anyone.

As a result of many debates the situation has recently become more favorable. The social scientific research programs developed for the duration of the Sixth Five-Year Plan indicate that the coolness toward the priorities and practical tasks directly aiding the state's work are ending. The selected research tasks and priorities may also be initiated, and indeed should be initiated, by scientists and not only by the directing organs, since a multifaceted approach is needed in recognizing the needs and in outlining the directions of action.

The efforts of scientific research to find its direction and to renew itself were greatly helped by one of the most significant scientific policy declarations of the last 25 years about the freedom of scientific research. This created in our country an atmosphere in which nobody has to hide his scientifically well-founded reasons under a bushel and nobody has to be cautious in debates. For a long time this has been not just a declaration but a reality felt by everyone; there are no prohibited topics and there are no required conclusions for real scientific examination, reliance on scientific results has become the basic interest of politics and confidence and creative dialogue characterize the relationship between politics and science. I would like to quote the words of Comrade Janos Kadar, spoken at last November's exapnded presidium session of the academy: "In accordance with the past practice of the Central Committee, it will not take it upon itself to decide scientific debates in the future, either. If we deviated from this, it would be harmful and wrong in our opinion. Scientific problems must be cleared up and decided within scientific circles and by the debate of scientists." Without fear we can put before our critical opponents this practice of the freedom of scientific research as an example.

What Is the Result?

It is at least as difficult to answer this question as to answer how much this result has cost us. Listing the numbers would not say much. As a starting point, perhaps we still must accept qualifying the results of scientific primarily on the basis of analyzing those complex effects that these results precipitate in the various spheres of social existence. In this manner then, if we say that the object of evaluation is the effect precipitated by the results, we are probably focusing on the essence. That is, it can hardly be stated that there are scientific results that for a long time do not precipitate any effects at all. Even though there have been instances in the history of science when the true effect of a certain result developed only belatedly (I could also give such examples from physics), no example exists for a true result that precipitated no effect at all.

Where and how can we look for these effects? Naturally we can look in the most diverse spheres and with the most diverse methods. For example, in the case of basic research projects in the natural sciences these effects appear primarily in international value judgments and in the reactions of the scientific opinion. Naturally there are many other effects of the results of basic research. They contribute to the enrichment of culture and to the improvement of scientific thinking; they also exert their influence in education and indirectly in the economy. In the final analysis, many factors need to be weighed in the evaluation.

The effects of research aimed at economic goals would be obviously pratical to characterize by the economic profit that these research projects--directly or indirectly-- produced. However, one must be wary of oversimplifications; unfortunately some kind of direct and simple relationship between the research expenditures and the economic profit precipitated by them does not exist. In the complicated system of mutual effects, the various effects that significantly influence the economic result often overlap and compensate each other. Therefore it is almost hopeless to separate the direct effects of research results in the profit from other effects.

With a certain amount of arbitrariness we can list the effects of results of scientific research basically into three categories. The first is the category of scientific informative effect. This category includes those effects that represent the expansion and spreading of our scientific knowledge formed about nature and society or that initiate new scientific theories and result in the modernization of education and thus in the advancement of general culture.

The second category is social effect. Those effects are related to the fact that the scientific results may develop various forms of social reaction, may exert influence on the political, ideological, legal, administrative, cultural and other spheres; and--even though they generally do not result in direct profit or economic advantage--indirectly may have a fundamental effect on the economic sphere.

The third category is economic effect. These results on the macro level affect the way the nation's income develops and on the meso and micro levels, the

profitability of the national economy's branches, subbranches and enterprises. These effects directly or indirectly influence the standard of living and the condition of the nation's well-being.

In all three categories the indirect effect of scientific methods is important in the most diverse areas of practical activity.

We must see clearly that the majority of the effects of the academy's research results surfacing in the second half of the 1970's are the consequences of research projects started much earlier. Generally more than 5 years passes from the conception of an idea and the decision following it until the actual result and the effects. When we introduce the results of a given time period, we are qualifying the initiatives and decisions of a much earlier time. We must examine and judge the effects only with consideration given to this important reservation.

First I would like to consider briefly how international scientific opinion reacted to the Hungarian results. We can obtain data about these reactions and about the informative effects of the research results the easiest and most easily reviewed manner from the international scientific literature. The analysis of the data and the appropriate conclusions are an internal matter of our academy, since Comrade Kadar justly observed in November last year, at the meeting of the academy's presidium, that the primary interest of our people is not whether we write good or bad articles about scientific research but rather what profits the research produced, the end product. However, in order to shape our self-esteem and our correct sense of proportions, but mainly to improve the quality of our work, it is not unnecessary for us to examine the impressions reflected by the international scientific opinion about our basic research results. We have performed the studies, relying on the data base of the Institute for Scientific Information, Science Citation Index. Since this data base does not contain data on articles published in social science publications--and even if it did, we could not use it as our basis, in the present phase, due to the lack of other, suitable data base--we were unable to extend our studies to cover the social sciences.

In order to avoid misunderstandings, I would like to emphasize that scientific results can be evaluated from several other important viewpoints in addition to the information-communication projection. In the following we will restrict ourselves first to analyzing publication activity; by doing so we do not want in any way to decrease the importance of the other viewpoints. The analyses based on various models are not competitors but mutually complementary components of each other.

The importance of analyzing publication activity is supported by the circumstance that the informational effect--that is, the extent to which the published information is used in achieving further new scientific results, and by these means the extent to which the international scientific public opinion recognizes and accepts it--has special significance in judging the quality of the research.

The new research results that promise large economic profits or are able to influence significantly the growth of military technology are not published anywhere, even though in many cases these are the ones that lead to significant

breakthroughs. At the same time, wherever such results are produced, basic research is generally also conducted and produces outstanding results, which when published indicate the general standards of the work.

After this, let's see the facts. From the quoted data base, from 1976 to 1980, 13,584 Hungarian articles were published in those magazines covered by the Science Citation Index. Of the approximately 8,100 articles published during this period by the MTA's research facilities, 3,360 (42 percent) can be found in the data base of the Science Citation Index, or 24.7 percent of the total domestic production. This is not a bad percentage if we consider that the share of the academy's research from the domestic financial resources is significantly smaller (12.3 percent).

In the interest of examining Hungarian data not by just themselves, we have selected seven countries and compared the domestic index numbers with the appropriately weighed index numbers of these countries. The selected countries were: Czechoslovakia, Poland, Austria, Finland, New Zealand, Israel and the FRG. Reasons can be given for the selection but not explanations acceptable to everyone. Therefore let us also consider the selection an experiment, just as we consider the entire comparative examination an experiment. By the way, the publication productivities of the first six countries listed are comparable with Hungary's, while that of the FRG (Hungary's largest capitalist trading partner) is a full order of magnitude larger.

Naturally we made the comparisons of the indexes formed from the national data, since there would not have been anything with which to compare the separate data of the academy. The conclusions--with certain restrictions--are valid also for the informational effects of the academy's research, or at least we committed no major errors in assuming them to be valid.

Characteristically for the distribution by specialty area of the Hungarian publications published in the last 5 years and found in the data base of the Science Citation Index, together with Czechoslovakia and Poland the share of the chemistry is outstandingly high (around 20 percent), while the clinical medical science's share is low compared to the other four countries. It is conspicuous, however, that the ratio of medical biological publications is highest in Hungary among the countries examined; this, however, is not accompanied by outstanding values of the quality indexes.

The studies show that between 1976 and 1980 the Hungarian researchers generally published or were able to publish their articles in magazines with low informative effects, with a low expectation of the articles being quoted. Among the countries studied, the Hungarian researchers published in the magazines with the lowest quotation rates in the chemical, biological and medical biological specialty areas. It is no consolation that this holds true for the researchers of either Czechoslovakia or Poland in other specialty areas. Based on this fact it seems justified to review publication channels and to initiate the use of magazines that provide greater informative effect.

The next, even more important, question is, How good was the actual informative effect of the articles published? Did actual quotation approach expected

quotation? In the countries studied, actual quotation is about 60 to 70 percent of the expected quotation, unfortunately Hungary with its approximately 60 percent is last.

The picture becomes more detailed if we conduct the comparison separately in the individual specialty areas. We find differences that can be evaluated well. In biology and mathematics the actual quotation of Hungarian publications supersedes the expected value but in the clinical medical sciences and geological sciences it falls significantly short of the expected value. However, with the exception of these specialty areas Hungary is near the end of the ranking indicating expected quotation (and is at the very end considering all the specialty areas taken together). It is easy this way to surpass the expected value.

Simplifying it, we can conclude that while the level of our research results (to the extent this can be judged on the basis of quotation) is average by international standards, the quality of publication channels used to publish the results is generally unsatisfactory.

I do not want to stretch the introduction of quality characteristics of the domestic publications. But on the basis of these studies, I would like to make a few more conclusions.

The effect of the Hungarian publications that can be measured by quotation is distributed relatively evenly in the chemical and physical specialty areas among the publications, which means that the quality of the publications is good on the average also. But in the other areas a relatively small "seed" raises the average quotation near or above the expected value. In this respect the Hungarian medical biology stands out. Among the seven countries, in absolute terms Hungary had the most medical biological publications but the overwhelming majority of them remain unquoted. Similar lack of proportion is seen with Polish technical and mathematical sciences.

The other conclusion concerns the frequency of outstanding effects. If an article is quoted nine or more times in one year, it indicates that the scientific opinion is showing significantly greater than average interest toward the work in question. Finland and Israel stand out among the countries examined with their relatively high numbers of much quoted articles. Hungary with its 0.45 percent ratio is almost on the same level with Austria and New Zealand and ahead of Czechoslovakia and Poland. In Hungary most of the high-effect articles came from medical biology, proving the cited high degree of qualitative polarization of this specialty area.

A number of critical observations, or at least reservations, can be made for the structure of the data base used in the studies and for the expected quotation indexes of the magazines. There is no opportunity to show these now but some general conclusions can be drawn about the Hungarian publishing activity. It can be concluded that:

--Hungary's publishing productivity corresponds to the expected extent on the basis of its economic development, and indeed it even exceeds it somewhat.

--The quality of the publishing channels used is generally insufficient. Perhaps even today the longlasting effect of that international isolation of Hungarian science in the first half of the 1950's contributes to this. By developing a more effective publication strategy, publication in internationally respected and professionally high ranking magazines must be encouraged in all specialty areas.

--The effect of the Hungarian publications measurable by quotation generally approximates the international average; in two specialty areas (biology and mathematics), it even exceeds that.

--In several specialty areas the level of the publications is extremely polarized. Besides a small, internationally recognized "nucleus" there is a large number of totally unquoted publications.

I would like to speak about the economic effects of the results of the academy's research. On the scientific basis, it is only possible to give qualitative evaluation about these effects--whether they are direct or indirect. When I give a few numerical data, I will be doing so only in the interest of comparisons. According to our studies, the results of the academy's research that produce economic profit, manifest themselves most often in new products (types of plants, materials, component parts, or equipment), new technological processes and, especially recently, new software. The new plant types occupy an outstandingly important place among the new products; the special instruments and electronic equipment as well as the measurement data-collecting and testing and control systems are significant.

The studies showed that in recent years the research institutions themselves were forced to implement the utilization of research results in a number of cases, since for either objective or subjective reasons the enterprises made no effort toward rapid utilization. But in some research institutions, management recognized a demand for paying results; in order to satisfy it, they organized the production and sale of products to ensure utilization of the research results, partly by using the institution's capabilities and partly through the cooperation of cooperatives and enterprises. We must consider this activity commendable, even though it would have been more desirable if the results were implemented in production and sales organizations and if the research institutions could have shared in the profit. This activity is commendable because some research institutions furnished significant assistance through this to break down the walls between science and practice and contributed to making the results of research into useful end products.

The analyses have also pointed out that the users showed most interest in methods and equipment that provide technological control. One probable reason is that the use of such methods and equipment may result in significant quality improvements with relatively small capital investments. The other reason is that in most cases these methods provide the opportunity to automate the technological processes.

Even though in the introduction I cautioned myself against listing some selected examples, I will mention two examples for the practical use of the intertechnological control methods. One of them is the X-ray fluorescent analytical

equipment developed by the Atomic Nucleus Research Institute in Debrecen for the Szekesfehervar Factory Unit of the Csepel Metal Works. This makes it possible to analyze a sample taken from the nonferrous metal furnace in 8 to 9 minutes and provides the opportunity to change quickly the composition of the alloy in the furnace as needed. During the first 10 months of 1980, according to information provided by the user, the equipment was used to check and qualify several thousand tons of copper alloy.

The equipment developed by the Technological Physics Research Institute and operating in the Danubian Iron Works is also noteworthy. It measures the deviation of rolled steel sheets from flat and makes it possible to make adjustments on the rollers, which improves the quality of the sheets. During the trial run high-quality sheet production increased by 60 percent on the experimental roller line.

As long as I have started to list examples, I would like to mention a few results with truly significant economic effects. First, engineers of the KFKI [Central Research Institute of Physics] created various process control and regulating systems, using the computers that they had developed and a modern module system. They sold these for several hundred million forints to the Danube Coastal and to the Tisza Thermal Powerplants, the Kama Automobile Factory, the Almasfuzito Alumina Factory, enterprises of the National Petroleum and Gas Industry Trust, etc. But the direct profit in the institute's income is dwarfed by the economic results produced by the users.

Second, the creation and domestication of eight corn types, two autumn wheat types and one new barley type is a significant result from the Agricultural Research Institute in Martonvasar. Nothing demonstrates economic effect better than the fact that over a 5-year period Martonvasar types were harvested on an average of 18 percent of the country's wheat growing acreage; in 1981 this percentage surpassed 35 percent. At the same time the planting acreage of Martonvasar corn types decreased.

Third, the research results that commends the workers of the Veterinary Science Research Institute made it possible to defend against viral diseases that basically endanger the profitability of large-scale poultry production and develop the necessary vaccines.

I will quit giving examples, even though I could list a number of results of many other institutions. I will ask forgiveness from those institutions whose results I did not mention even though I could have possibly talked about results of even greater effect had I done the selecting a different way.

In some respects, the implemented patents reflect the economic effect of the research results; the patent fees provide information about the actual economic profit. During the report period, employees of the academy's research facilities made 347 domestic and 192 foreign discovery reports. The number of patents granted was 153 in this country and 74 abroad. One of the reasons for the difference is that invention increased significantly during the last two years, while at the same time, unfortunately, the processing time for the patent process did not decrease much; thus some of the reports made in the last two years

are still being processed. However, compared to similar data of the previous 5 years, these figures represent a noteworthy improvement. About 5.5 percent of the Hungarian patents applied for in this country come from the academy's research facilities.

The patents were used on 431 occasions, collected patent fees totaled about 110 million forints. Of this, 43 million forints were paid to the inventors. These numbers do not show significant economic effect. The academy's work aimed at the utilization of patents must be made more successful; more emphasis must be given to obtaining international patents for inventions that can also be sold abroad.

The three largest patent fees during the report period were paid for the following patents:

--process for postconstruction insulation of architectural and engineering creations, 3.41 million forints;

--process for increasing the water-resistance and rigidity of concretes and mortars made with the use of cement, 2.17 million forints; and

--data-processing equipment with at least one processing unit connected to a common data transfer channel and at least one memory unit, 1.68 million forints. Surprisingly these well-paying patents are far from the academy's fundamental research areas.

Even though the opportunity exists in Hungary for patenting new types of plants, no such reports have been submitted since there are conflicts between the state's type recognition and patenting. The consequence is that the new domestic types enjoy no protection aborad, which can provide the opportunity for numerous abuses and may also inflict economic damage.

Incomes derived from the sale of licenses are also low in the academy's institutions. In recent years, unfortunately no significant license sales have taken place, which means either that the academy's institutions were unable to offer licenses promising large economic profits to the enterprises or that the enterprises did not have the ability to purchase such licenses. It is worth considering, in any case, how we should change this situation, since several new scientific results of the academy are knocking on the gates of the enterprises in the areas of pharmaceutical research, plant protecting chemicals research, biotechnology, information technology and space exploration.

Due to their nature, the effects of research results in the social sciences manifest themselves in indirect, complex and at the same time different ways. No acceptable methods exist anywhere in the world for following the scientific informative effects. Therefore I was especially pleased that some of our noted researchers have undertaken developing methods to make the study of such effects easier. In developing these methods, attention must be paid to the analysis and evaluation of the most varied types of effects, since the effects of a dictionary, an atlas, a manual-type synthesis, a study serving to prepare for a decision or an outline of a new theoretical idea are all different. A research

result dealing with a uniquely Hungarian topic has a different effect from that of a scientific production without international boundaries. It is also obvious that the ideology-forming, consciousness-forming, culture-expanding, moral and aesthetic effects of the results of research in the social sciences will be delayed, therefore they can be studied only years later.

Preliminary information shows that broadly effective methodological results were born during the last 5 years in the areas of historical and philological research. The application of the comparative method has become universal.

Numerous important document collections, data repositories, bibliographies, dictionaries, atlases and other supplements--of great value especially for the future--have been prepared. The more accessible these become to professional circles, the greater their scientific and informative effects will be.

Monographs and the more significant studies fulfill an important role in strengthening the scientific-informative effect. Some period monographs in cultural history initiated important research projects, several monographs and studies attracted significant international interest. Reading the reviews, it can be concluded that the monographs dealing with the era of change in the world's economy, the theory describing and explaining shortage, the relationship between man and his life style, the connection between the center and periphery, the interrelationships between being undeveloped and the economic growth, etc.,have been recognized and started fruitful debates. These and other writings provide a realistic picture about the country's situation and analyze the difficulties, contradictions and, in a number of cases, the alternatives for further progress.

Experience shows that the results, methods and debate-causing conclusions of research in the social sciences favorably influence the public's thinking and exert an effect on education and public culture. For example, many consider favorably the effect that the academy's research as a whole in the linguistic sciences triggered in native tongue education and in preservation and development of the native language cultures. The volumes of the manual "Hungary's History" that have been published so far and sold in large numbers, are used successfully in training historians and in general university education. Great interest and expectations are being shown toward the volume that will show the time period following liberation. Historical interest is spreading increasingly not only in scientific but also in the public's thinking, which is heartening; credit for it is due in part to the results of the academy's historical research.

Studies to fulfill specific assignments have also been given room in recent years in the academy's social science research; some of these have been successfully concluded. It can also be considered gratifying that participation of the social science research facilities has increased in preparing and providing scientific foundations for the national decisions and the party's positions. The work on foundations for developing our price system and modernizing our production structure, and all the activity that our institutions performed in the interest of predicting the world economic processes and for the national economic planning, were particularly significant.

But we cannot be satisfied with the practical results of the research to modernize the public administration. In this area the government justly criticized the academy's research. However, the academy's research in legal sciences made a significant contribution to preparing various statutes. It is hoped that the measures will also help make public administration research more goal-oriented. The research on socialist enterprises--which, by the way, has produced many important results--is also laden with problems; its unique organizational framework and managing characteristics have only increased the difficulties.

In conclusion, even accepting the risk of an error, I would like to make two more general observations. First, in this recent time period perhaps it would have been desirable to strengthen the theoretical character, the theoretical requirements in the academy's social science research, and to provide greater encouragement for surpassing the customary descriptive approach, and for experiments to create theories. Even though noteworthy theoretical results were born in the area of economic science and historical science research, they did not always relate to the big questions of historical and social progress. This much cannot be said about the other specialty areas; what is especially regrettable is that this is not the situation in philosophy, which most requires generalization. However, the requirement of valuable theory-creating experiments is not in contradiction; on the contrary, it closely agrees with fulfilling the practically oriented research tasks to high standards. I am observing this so that we will not contrast the theoretical requirement and practical usefulness, willingly or unwillingly, with each other.

My other observation is related to the large syntheses, to the large collective jobs. Not to debate the significance of these for one instant, and acknowledging their necessity and their roles of creating something new, it is worth calling attention to the correct proportion of tasks and goals. Besides the systheses, and even within them, it is practical to support the development of new directions of research, the ones deriving from the internal logic of the social sciences as well as the ones oriented at social practice and also having theoretical requirements. Several initiatives have been taken in the last 2 years in the interest of this.

Reviewing the effects of the results of the academy's research in outlines and with varying emphasis, the question occurs. What can be said in summary about the quality of the achievements? First of all, quite outstanding performances blend with mediocrities in the average quality that may be called acceptable; the ratio of the latter is, unfortunately, larger than desirable. We must see in this not only an objective manifestation of the laws of statistics but also the effects that external and internal conditions have exerted on performance and the weaknesses of our own work.

However, the academy's scientific results achieved in the second half of the 1970's represent great value; their effects are in the process of developing and may play a significant role--indirectly, and in some cases also directly--in the domestic social, economic, and cultural growth. But so far they have not caused any real breakthroughs in the standards.

How Much Did the Academy's Research Cost?

I would not want to bore the general meeting's highly honored participants with an avalanche of numbers. In the interest of judging our opportunities with an approximate sense of proportion, I consider it necessary to mention a few key numbers.

According to the data of the Central Statistical Office [KSH], between 1976 and 1980 the country spent 94.1 billion forints on research, mainly on development. The share of the academy's research facilities was in round figures 11.5 billion forints from this, or 12.3 percent. However, the national budget contributed only 4.8 billion (42 percent) of this 11.5 billion forints; the larger part, 6.7 billion forints, came from incomes for fulfilling research and development contracts. During the 5 years, from the 11.5 billion forints we spent

2.3 billion forints	for wage-type expenditures
2.8 billion forints	for investment purposes
2.9 billion forints	for direct research expenses
3.5 billion forints	for miscellaneous indirect expenses.

It is difficult to establish accurately the shares of the individual scientific branches. It appears from our studies that the share of the technological, agricultural and medical sciences is relatively low, even though the academy does not have the primary responsibility for their development. Jointly with our partners, we must examine the extent and conditions for the desirable modification of the proportions.

The academy's expenses for research increased by an average of 10 percent per year between 1976 and 1980. This increase only partially compensated the approximately 14 percent per year increase in operating costs accompanying the rise in price levels.

The full sum of the academy's actual expenses was 14.7 billion forints. With the 3.2 billion over the 11.5 billion, we covered the costs of scientific qualification, other budgetary organs not engaged in research, the library, vacation homes, etc.

In order to judge the actual weight of financial resources, it is necessary to furnish the research working time base of the academy between 1976 and 1980. The research facilities of the academy used, in round figures, 14,600 researcher years, which represented the working time base of an average of 2,920 researchers. An average of 788,000 forints is spent per research year of the working time base; in the social sciences this is only 158,000 forint.

These numbers can receive the proper weight if we compare them with the international data. This is a difficult task, which cannot be solved precisely; yet the comparison is justified even if only on the basis of approximate estimates. Considering the annual averages of the dollar exchange rates, our expenditures over the 5 years are equivalent to about $300 to $400 million. According to this, the amount spent per researcher in Austria is 4 1/2 times, in Sweden and in the FRG 5 times, in France 6 times, and in Czechoslovakia 2 times the academy's expenditures. No matter how inaccurate these ratios, we must increase

the expenditures per researcher, even if this can be accomplished only at the cost of decreasing the quality improvements in the number of researchers. Otherwise we cannot stand our ground in international competition.

In order to characterize the full manpower inventory of the academy's research facilities, at the end of 1980 there were about 3,100 researchers, 2,000 research assistants and 3,500 workers listed under other job categories, for total employment of about 8,600.

The average age of the researchers increased from 38 years in 1976 to 39.6 years in 1980. The age of 24 percent of the researchers is still under 30. About 920 people have scientific degrees, 30 percent of the total research manpower.

Between 1976 and 1980, only 183 researchers participated regularly in the university's educational work. It is characteristic of the pseudomobility of researchers that during the 5 years about 550 researchers changed to new, predominately research jobs; about 1,000 entered the academy's employment.

During the last 5 years the wages and income of the academy's researchers unfavorably compare similar strata. The social importance of scientific work--and specialized knowledge and education--is not recognized everywhere; thus, it is not even appreciated, even though there is a whole series of national decisions and party resolutions dealing with the outstanding significance of creative scientific work.

In addition to the good idea and careful work, the success of research depends basically on the level of the technological equipment. The modernity of research equipment, of the analytical, measuring, examining, and preparatory instruments, and of the data-collecting and -processing systems; the extent of automation and computerization, etc., play definitive roles in ensuring the success of research work. What was the change in the technical equipment of the academy's research between 1976 and 1980?

In 1976 the gross value of the academy's research equipment inventory was 2.4 billion forints; its net value was 1.4 billion forints. Thus, the degree of obsolescence was 58 percent, which unfortunately represented unfavorable starting conditions. The actual situation is worse than the numbers because the obsolescence index had to be calculated with an unrealistically low 6 percent amortization key. In 1980 the gross value of the equipment inventory increased to 4.3 billion forints and its net value to 2.3 billion forints, the degree of obsolescence changed to 53 percent. But this 5 percent decrease in obsolescence did not bring, and could not have brought, a significant change. Perhaps the computer availability has improved somewhat with the purchase of the IBM 3031 machine and with the startup of several small computers. Between 1970 [sic] and 1980, 37 significant purchases of research equipment were made; this can be considered a nice performance under the deteriorating economic conditions. The purchases can be justified even with today's outlook, since they created better and more modern circumstances for scientific work. About 35 percent of the sum spent on machinery and instrument investments served directly the research projects in progess in the main resaerch directions. Based on studies it can be concluded that in essence the investments implemented during the plan's time period have prevented unjustifiable "white spots" from developing in the research equipment supply.

Utilization of large-scale reserch equipment is not uniform. What is even more important than formal level of utilization is, for what and with what results the researchers use the expensive research equipment. The answer to this question can be provided by thorough evaluation of the research results at the research facility.

What Did International Scientific Cooperation Produce?

Today it is common to talk about the significance of international scientific relations in research work. Therefore, instead of repeating the theoretical considerations, I would like to show only a few data and a conclusion or two about the international relations of the time period between 1976 and 1980.

In 5 years our academy spent 150 million forints on international relationships; research institutions earned 20 percent of this, 30 million forints, with their own incomes. A total of about 19,600 trips abroad were made, 65 percent to socialist and 35 percent to capitalist countries. Unfortunately only a small number, 590 trips, lasted more than 3 months. What is even sadder, a smaller ratio of even these were made to the socialist countries. The amount of travel costs per researcher increased significantly during the last time period, from 7,500 forints to 12,300 forints. This represents an increase of 63 percent.

The results of international scientific cooperation must decisively manifest themselves in research work. The effect of the relationships developed during the cooperation is much broader in scope than this: they may promote economic cooperation, contribute to improving the conditions of the political dialog and to strengthening mutual trust. The domestic research, and within this, the academy's research may be tied with many, repeatedly renewed threads to the international scientific life and to the noted foreign work shops of research work. In the last time period our relationships with Soviet science and with the creative scientific work shops of the socialist countries played an outstanding role in these relationships. It is unnecessary to emphasize that in the future we must reinforce these relationships, we must take better advantage of the potential opportunities in them, we must provide increasing support to the successful cooperative projects and be more courageous in eliminating nonproductive formal activity. In the case of mutual advantages--considering the experience gained in recent years--the scientific institutions of the nonsocialist countries must also be developed further.

Our international political interests require that the scientific relationships should not feel, or feel only slightly, the fluctuations of the political relationships. Scientific relationships can be built up only slowly; they can be broken and ruined that much quicker. The relative constancy of scientific relations may also help in the reorganization of political relationships, which may become necessary from time to time.

Between 1976 and 1980, there was cooperation on about 860 research topics between the academy's domestic research facilities and foreign research facilities. This number does not say much by itself. If--relying on expert opinions--we add that the efficiency of cooperation was good in only about 60 topics, and in nearly 340 topics there were no results or the level of the results achieved was low, then the fact that on 460 topics acceptable mediocre work was being done,

does not give us the right to make complimentary statements about the average success of international cooperation. Of course, everyone can cite a good example or two but this does not change the situation.

Experience in basic research shows that the outstanding results were generally born in those topics in which the researchers cooperating had common interests, which the researchers themselves initiated, and which at the same time also received encouragement and support from the management. Some of these personally initiated working relationships later became recognized and highly important cooperative projects and served well our fundamental research policy interests.

In summary, the international activity of the academy's research facilities grew significantly in size and extent during the 5 years, but in an uneven manner in terms of its success. The initiative ability and independence of the institutions increased but there was no adequate coordination and sense of proportion realistically considering the possibilities. The material supply deteriorated significantly, and even in spite of numerous earlier positions taken, the international scientific cooperation and its handling did not become internal, organic components of the research activity.

About Management

A long list of contradictory opinions could be given about the manageability of research and about the merits and faults of actual management. Due to time, I would like to touch upon just a few questions.

The experiences of recent years have repeatedly proven the conviction professed by many people that discovery of the unknown phenomena of reality, the laws that govern them and the great discoveries cannot be directed in the everyday sense of the word. The new and unusual thoughts, the daring theories and the discoveries that are surprising in the beginning but later appear annoyingly simple, are not born from directives but in workshops of science that have a good atmosphere and unfortunately even there rarely. Therefore I am perhaps not making an error in stating that the basic research projects that--if we are sufficiently patient--may once in a great while surprise us with pearls, cannot be directed in the ordinary sense, only influenced. They can be influenced by the debates, analyses and suggestions that direct the attention of the researchers to the movements in the international front lines of science and to the interconnections that cannot be seen well on the horizon of the narrower specialty field. Of course, they can be influenced with the material and financial means, which, when granted, expanded, or withheld, will directly or indirectly affect the conditions of research work.

When influencing with material means, in granting or withholding support, we must consider the results of past work as the basic criterion. If it is outstanding, this is an encouraging recommendation for the future. However, successful work is often preceded by unsuccessful work; therefore there is a need for patience and sensible acceptance of risks in the organizations responsible for management.

intensive support to basic research would be especially important in several areas. We must list modern biology among these areas, which is important not only to health care, agriculture and the pharmaceutical and plant-protecting chemical industries but is increasingly becoming a strategic factor of the entire economy. It is necessary to face the expected effects free of illusion, to estimate the possible results without exaggerations and to concentrate a portion of our resources on these research projects. The micromaterials science laying down the foundations for consciously regulating the characteristics of micromaterial quantities promises to become an area of outstanding importance. This creates the possibility of performing various, primarily logical, functions in amazingly small material quantities and is expected to be preparing a new revolution in microelectronics. The systems-approach basic research projects serving to discover the condition changes, dynamic behavior and sensitivity points of ecosystems, are significant. Within basic research, certain theoretical research projects deserve significant attention. It is general knowledge that the Hungarian researchers produced internationally noteworthy results in mathematics, theoretical physics, the theoretical branches of chemistry, economics, sociology--I could keep listing them. This must encourage us to increase support in these areas. The general and special importance of the social sciences also demands particular attention and support in shaping our future, especially for basic research in the interdisciplinary social sciences. Naturally this listing cannot claim to be complete and rather serves to illustrate the possible directions.

The job of the next time period will be for us to outline the most important directions of basic research to be cultivated in this country, or at least what is considered such today, with the active cooperation of those skilled in this and on the basis of responsible positions taken by the scientific bodies, in accordance with the new requirements of the new times.

The internal direction of basic research is determined over the longer range by the social driving forces of the work performed to discover unknown phenomena and laws and to create new ideas and theories. These driving forces sooner or later exert their effects. In the area of basic research the primary job of research management is to create the conditions in harmony with the realities for the optimum operation of these driving forces. This kind of direction can only be deeply democratic because preparation of the decisions that represent influence can be accomplished only in creative debates, based on the responsible positions taken by competent scientific collectives.

The general secretary of the Hungarian Academy of Sciences is in the fortunate position of being able to rely far-reachingly on the opinion of the scientific bodies as well as of the members of the academy before making these decisions. Perhaps it is not be completely one-sided statement that in the recent time period the relationship has strengthened and improved between the scientific bodies and the academy's organs responsible to the national government for directing the research. In order to solve the increasingly difficult problems of the present and of the future, there is a great need to foster this relationship, and to have unity based on theoretical debates; however, we will have much to do to create and strengthen this over and over again.

Naturally a significant portion of the academy's research is also closely related to the actual problems of economic and social growth. In these research areas direction must face much more closely defined tasks. The decisive question here is, How can the directing help and organize the correct selection of research goals and how can it help society learn the achieved results quickly? Analyzing the experience of the recent time period, it can be concluded that the academy's research management participated with increasing efficiency in coordinating the planning process but it has still neglected to influence the planning work with prognoses and concepts. It appears that the statement is again justified, that we have not succeeded in overcoming the elements of formality in research planning; the changes--in most cases, deterioration--in the material and personnel conditions needed to achieve the plan's goals were not followed by modification of plans or flexible selection of goals. We can report improving work in organizing and controlling the implementation of the plans, credit is due to, among other things, the active cooperation of the individual corporate organs and the scientific committees and to the reasonable use of continuous reporting. We did not succeed, however, in developing a system of criteria which bureaucracy and subjectivism in judging the performances could be significantly decreased. It is possible that such a system of criteria is difficult or totally impossible to develop, but a final judgment cannot yet be pronounced on the basis of efforts to date. The outlines of a possible path are perhaps indicated by the scientific study of the effects triggered by the research results. But much work still has to be done on this; the active cooperation of the researchers is needed.

A basic question in connection with all directing, including directing the academy's research, is, What are the tools with which directing can be accomplished, and to what extent can they be used? Without trying to be complete, I would like to mention a few of these tools. They are, for example:

--distribution of the investment goods;

--manpower modification (increase or decrease);

--distribution of the budgetary support;

--support of competitive entries from the Central Research Fund;

--regulation (expansion, tightening) of the participation in international cooperation;

--evaluating the activity of the leaders under one's sphere of authority;

--issuing directives, regulations, etc.

Besides these tools, other--relatively less effective--methods are also available for directing, such as:

--defining the guiding principles of planning;

--working out analyses, prognoses, and concepts worked out, distributing them, and having the positions defined in them accepted;

--publicly and democratically evaluating the research results;

--supporting the significant initiatives by researchers;

--developing democratism based on the acceptance of responsibility and extending the right to a voice in decisions.

We have conducted careful studies in order to learn the extent of freedom for the academy's research management in using these tools. First, I want to make some remarks about the role of financial tools in the academy's research management. In recent years the shortage of means that has become constant, forced us to make a number of predetermining decisions, which made any significant path modifications almost impossible. Each year was subjected to the pressures of the burdens, the well-considered or ill-considered undertakings of the previous years; that in itself also created burdens on the following years. Because of this, then, with the most effective tool of direction, with the tool of financial influence until now only disturbing effects could be achieved. The high degree of sensitivity of the research network increased the difficulty of implementing the necessary modifications; the failure to recognize the real difficulties and the already mentioned lack of resources only increased it.

This situation cannot be preserved. We must take definite measures in the interest of being able to make our decisions about the use of the financial tools not as prisoners of past decisions but increasingly--even if this means accepting conflicts--with a certain degree of freedom of the opportunities.

Even though the competitive entries financable from the Central Research Fund offered a modest opportunity for new initiatives even before the real progress was created by the fact that mainly the major research institutions--taking advantage of the benefits of research under contract--have embarked on the path of enterprising. By doing so, they have to a certain extent allowed the directing effect of the needs of the contracting customers justifiably to prevail.

By the way, the number showing that between 1976 and 1980, 6.7 billion forints, or 58 percent of the incomes related to the academy's research and development activity, was derived from the enterprises, convincingly illustrates this situation. The Central Research Fund can also thank this successful enterprising activity for its existence.

In reviewing the process developed in recent years, the enterprising desire of the academy's research facilities should be strengthened; it must be made possible for them to reach full or partial financial independence; new formats must also be sought for this. This way perhaps some of the budtetary assistance could become better usable to support partly the basic research and partly the large and comprehensive programs. Through this it would be possible to decrease the extent of determination that exists in the utilization of the financial means.

As far as the other tools and methods of direction are concerned, we are far from having exploited the existing opportunities. The situation analyzing studies, prognoses and concepts of the corporate organs, scientific committees

and outside experts must be given a greater role in the planning work of the research facilities. We must also make better use of the studies that the OMFB [National Technical Development Committee] ordered, and debated. Directing the academy's research must approach the economic and social crisis and at the same time research itself; its helping, supporting, coordinating, contact-creating and evaluating functions must prevail better. Only this way can it fulfill its great and honorable job of serving science.

About the Jobs That Need To Be Done

In accordance with my decision I talked about the past, not because I have forgotten Szechenyi's words--"The past has fallen from our might, [but] we are masters of the future"--but because I wanted to direct attention to the tasks of the future. I do not want to speak in detail about these tasks but would like only to summarize those features and requirements considered most important, which characterize these tasks.

The significant but not exactly foreseeable changes expected for the 1980's further increase the role of the socioeconomic factors in scientific research, and vice versa. Active participation of science and research is becoming increasingly indispensable in finding new paths of socioeconomic growth and in developing unavoidably necessary renewal.

In accordance with this, the academy's research must give preference to those highly significant and comprehensive socioeconomic problems of key importance from the viewpoint of the domestic economic growth and naturally of the development of the entire society. In working out their alternative solutions, the social scientific, technological, agricultural, health care and natural science research facilities must cooperate in a better and more organized manner. This requires that the management of the academy's research help break down the dividing walls built of unique but intolerable local interests that hinder the cooperative work, by modifying the interest circumstances and increase the tolerance capability to help bear the sensible and necessary changes.

An important research policy task of the 1980's is to adjust the structure, organization and method of operation of the academy's research to the new conditions on the basis of carefully analyzing the human factors that motivate the interests, in order to increasing the social usefulness of science.

Considering the expected burdens of the 1980's, to a significant extent we can implement the increase of performances and quality by the reserves concealed in our intellectual resources and from the potential opportunities of the new interventions. This requires, among other things, lively basic research, which provides real values, searching out and intensively supporting the talents, and a scientific atmosphere that encourages finding new truths. The academy's research policy must start from the realization that basic research is the "lungs" of the entire scientific organization, which must breathe freely and that basic research is indispensable for keeping the innovative processes alive, and to improving constantly the quality of the intellectual background and scientific thinking. At the same time this research policy must also know that society expects a concrete profit from the scientific efforts. Therefore we must encourage, aid and organize the practically oriented research undertakings of the academy's research facilities.

The 1980's will demand much from the workers of science, under relatively severe conditions. It is important that the judging and evaluation of the performances be more thorough and outspoken than in the past. Scientifically based qualifying methods and multifaceted and differentiated evaluation of the effects triggered by the results of research are needed for this, because qualification cannot remain without consequences. The academy's research management must promote polarization; those who produce outstanding results receive increased support and those who produce illusions receive rejection. Support by scientific opinion and the active assistance of those who can recognize the real scientific values is needed for this. Unavoidable difficulties and our intentions of defending and increasing what we have, require outstanding work; perhaps we will even be able to produce better than the average.

Although talk has run long, I was unable to talk about many things about which I should have talked. I have only touched upon the expected problems and hopes of the 1980's, but I allowed for some predictions of the 1980's as the decade of great efforts and significant changes, which must bring about the construction of new and more efficient development paths for the success of our socialist country and people.

8584
CSO: 2502/89

COMPETITION FOR DESIGN OF ELECTRONIC CIRCUITRY

Budapest MUSZAKI ELET in Hungarian 2 Sep 82 p 2

[Excerpts] A competition for development of basic type GATE-ARRAY and ULA circuitry compatible with Hungarian technological potential has been announced by the Central Electronics Development Office of the Hungarian Communications Engineering Association and the Government Committee for Microelectronics. In the judgment of entries, the following aspects will be considered in addition to the general technical-economic level of the result: TTL/CMOS compatibility, rentability of production (ratio of complexity to output), speed attained through the selected technology, the degree to which concrete applications have been worked out.

Entries must include detailed technical description and specifications of the device; measurements which verify specification data; at least 10 mask steps permitting estimation of yields and containing 10 fully metallized incomplete circuits; all documentation and descriptions needed for reproducing the masks adapted to the requirement of the technology selected.

Entries must be accompanied by a sealed envelope containing the name, or in case of a team, the names of the entrants. Entries which are rejected will be destroyed. Information included with the entry will be treated as an official secret. Should the entry be accepted, conditions needed for its realization will be created. There are to be one or two first prizes of 80,000 forints and two or three prizes of 50,000 forints each. Works suitable for realization and the right to do so will be purchased under separately negotiated contracts.

The deadline for submitting entries is 30 April 1983.

CSO: 2502/1

BRIEFS

NEW, SMALL COMPUTER--Assembly of a new small computer developed by the LSI ATSZ [LSI Alkalmazastechnikai Szolgalat: LSI Applications Technology Service] has begun on a cottage industry basis at the New Life agricultural producer cooperative with the assistance of electrical engineers and electricians. The typewriter-sized computer can be used for billing, office administration, teaching and in medical technology. The basic machine costs only 34,000 forints and is called the Mickey-80. Its success is indicated by the fact that the first 25 units of its zero series have already been bought by hospitals, schools and plants. Production of 300 such small computers is planned for the near future. The basic user software is prepared by the LSI ATSZ; prices are set on the basis of competitive bidding. [Text] [Budapest SZAMITASTECHNIKA in Hungarian Jul-Aug 82 p 1]

CSO: 2502/3

COMPUTER SYSTEMS DEVELOPMENT, REORGANIZATION OUTLINED

CAMAC Computer System

Warsaw PRZEGLAD TECHNICZNY in Polish No 5, 11 Jul 82 pp 26-27

[Docent Dr Eng Roman Trechcinski, director of the IBJ [Institute of Nuclear Research] Nuclear Electronic Bureua; Magister Eng Miroslaw Herman, technical director of the POLON Association of Nuclear Equipment Plants; and Magister Eng Czeslaw Dryja, deputy director of technical affairs at the ZAE [Electronic Apparatus Plant], interviewed by Mieczyslaw Komuda; date and place not specified]

> [Text] CAMAC--Computer Automated Measurement and Control. Originally it was developed as an interface devise between an automated object and any computer. However, after large-scale integrated circuits were introduced, especially in microprocessors, the intelligence contained previously in computers was transferred to the system. Thus the system in effect became a universal digital computer, that is, a computer that can control any object.

[Question] KODAK's advertisement at the turn of the decade urged buyers; "You push the button, we do the rest." Is CAMAC an example of the materialization of this blustering advertisement?

[Trechcinski] Of course, modular digital systems are used extensively to automate production processes. After all, many such systems have emerged. I suppose that there have been hundreds of them, but one of them, CAMAC, triumphed and achieved a world standard level. The ESONE (European Standard of Nuclear Electronics) Committee developed the CAMAC system. ESONE is an unofficial organization of laboratories engaged in, literally speaking, atomics. It is unofficial because it is a voluntary association of laboratories that arose and functions outside the United Nations or any other large international organization.

[Question] Of what time period are we speaking?

[Trechcinski] ESONE began in the 1963-1964 period. The first document concerning CAMAC, called "4100," was issued in 1969.

[Question] Did ESONE commend the system or did it develop the idea?

[Trechcinski] It developed the idea. Perhaps CAMAC may not have been better than other systems that were developed at the same time, but it was based on the organization of that committee. The organization did not require licensing or a contribution, but it offered the free use of its developments which cost several scores of millions of dollars. Basic standardization documents were developed. Those who want to take advantage of the system receive all that free.

[Question] Where did this excellent information come from?

[Trechcinski] I am a member of the ESONE board, the superior organ, the so-called Executive Committee Group.

[Question] What other socialist countries beside Poland belong to ESONE?

[Trechcinski] Yugoslavia, Romania, Hungary, the GDR and the Association of Institutes of Nuclear Research at Dubna are members. The only condition stipulated in the statute is that an Esone member must be a nonprofit organization. There are no nonprofit limitations.

[Question] The year was 1964. Did Poland have its hand on the pulse from the very beginning?

[Trechcinski] We found out about the system somewhere around 1968. Four systems were functioning in Poland at that time in atomics alone. It was a monstrous production situation. Thus a struggle over CAMAC began. Supporters and opponents of the system appeared. It was extremely difficult to come to a common agreement and to obtain government approval to liquidate all existing systems and concentrate exclusively on CAMAC. We finally obtained such agreement in December 1969.

[Question] At that time, what was the state of computer technology in Poland?

[Trechcinski] It was barely the beginning. There were few computers. The K-202 was the most suitable for CAMAC. Concerning electronics, it was the era of transistors.

[Herman] It should be remembered that at the POLON ZAE vacuum-tube apparatus were still being produced; a modular vacuum-tube system is totally unsuitable for operation with computers.

[Trechcinski] Thanks to the introduction of CAMAC, we obtained that apparatus.

[Question] But how did that introduction of CAMAC come about?

[Trechcinski] We offered a proposal to ESONE which was accepted; then we obtained all the basic documents. The production of CAMAC modules was initiated sometime in 1973 by the POLON ZAE and the ZUP [Plant for Industrial Equipment] in Krakow. In 1972, we developed a module which interfaced with

the K-202. When K-202 production ceased, we had to develop our own design. It was then that the first automatic processor, a CAMAC module, appeared as a stand-alone computer. The series production, though small, continued for many years. Then we built MERA 300 interfaces based on the so-called MOMIK computer, followed by interfaces with the ODRA 1325. MERA 400 interfaces also were developed. SM [minicomputer system] and MERA 60 series interfaces are being produced. Of course, CAMAC interfaces with all Western computers.

During the 1974-1980 period, the ZAE was preparing for the production of equipment for the CAMAC system; this equipment is now in production. These are multifunction units which enable several hundred expanded systems to be created.

[Question] Let us say something about the application.

[Dryja] The most spectacular example of a CAMAC application is the Belchatow Electric Power Plant computer system, a system that gathers data from the power unit (about 2,500 different analog and digital signals). It gathers information, shapes it in accordance with the complex technoloyg of the unit's operation, presents the information to the controller and records it in memory; thus it is possible to recreate the prebreakdown status of the unit. This system permits economical operation of the 360-MW unit. We have an agreement which defines precisely the conditions for delivering such systems for all 12 units at the Belchatow Electric Power Plant.

[Question] Is the application of CAMAC more limited?

[Dryja] Colleagues from the COTM [Central Institute of Medical Technology] built a system to monitor childbirth activity using our units.

[Trechcinski] In a few days my daughter will be giving birth there. I will be a CAMAC grandfather, so to say.

[Dryja] Between these two most spectacular examples of applications, there is an extensive range of industrial applications, that is, small, autonomous systems using minicomputers. Some examples? A console to measure and control transformer parameters at the Skierniewice Plant; investigation of turbine blades at the Zamech Wind Tunnel; systems at stations to investigate internal combustion machines, and so on. All these applications are examples outside nuclear technology. I would like to emphasize this strongly because I would bore the readers by giving examples of applications in this actual field. It is enough to mention the spectrometers having different configurations and applications or even the small stations to receive and process data.

[Herman] The system designed to aid the operation of the 360-MW energy unit is a large system. It costs upward of 26-30 million zlotys. It is the most extensive system built on a semiseries scale (12 systems are a series production). It is the most modern CAMAC design with the latest generation of subassemblies.

[Question] What is the scale of production?

[Dryja] We are producing about 10,000 devices in 50-60 assortments. This permits the construction of at least several hundred systems annually. For example, we supply 200-300 systems annually to the USSR.

[Question] Are we the only producer of CAMAC units among the socialist countries?

[Dryja] No. But we are the largest producer. Hungary, Czechoslovakia and the USSR produce small amounts of CAMAC equipment.

[Question] How modern is your equipment?

[Dryja] It is difficult to evaluate oneself. We are almost a monopoly in the CEMA market. In fact, we impose a certain design style. Some designs, for example, those included in the Belchatow system, are comparable with Western designs.

[Question] Does CAMAC have a future?

[Trechcinski] When such a type of apparatus is used for automation, then the average profit resulting from such applications approached 400 percent of the value of the apparatus. Thus it is not surprising that the trend in applying CAMAC systems to automation is very strong. The many new systems that continue to emerge demonstrate this. Literally each year names of new modular systems appear. It appears that the future of this type of apparatus is guaranteed, and for many years at that. According to Western estimates, CAMAC itself will reach its peak more or less during the mid-1980's. We are not worried about demand for our production up to 1990.

[Question] What are the prospects for production?

[Trechcinski] If we are going to produce the CAMAC in plants now belonging to the PAA [State Atomics Agency], then we cannot count on any significant increase in the scale of production.

[Question] Will it be necessary to increase production?

[Trechcinski] There is no problem in Poland with markets. I agree that currently we are not utilizing all the capabilities the system provides. Our activity is based primarily on the sale of units in bulk. Considering total sales, only a small percent end up in complete systems. Many more CAMACs could be sold if the production base were adequate.

[Herman] I believe otherwise. In the next 2 or 3 years the possibility of increasing CAMAC sales in the domestic market will be minimal. There is an economic crisis. Industrial plants and especially scientific institutions are counting every grosz and they will be unwilling to invest. It appears that only sometime around the end of 1983 will a new type calaculation start in Poland: that it will be profitable to automate production. Today the need to give out money for CAMAC works against it.

[Question] Then how will you manage over the next 2-3 years?

[Herman] Starting in 1974 with CAMAC in the Soviet market, we estimated the absorptive power of this market at 6 million rubles annually. Today our production sales there are 10-12 million rubles, and we know that we could have sales of 20 million. In a word, there is a market and production can be increased.

[Question] How many people in Poland are involved with CAMAC?

[Dryja] About 1,000 people are employed directly in production, and several hundred people are involved in development work.

[Question] Will the reform help or hinder your plan?

[Dryja] Let us above all remember the doubts. For the time being, the reform will not produce any obvious advantages for us. It seems that a plant that exports over 80 percent of its production should have resources to develop these products technically to say nothing about the technical development of the plant itself. At the moment, these resources are a bit small, and additional funds must be taken from the profit pool.

[Herman] Our export index is high and, in association with this, in the framework of the reform we are approaching the top income tax of 90 percent. In other words, 90 percent of our export profits are paid to the state treasury. Before the reform, the export tax was 80 percent.

[Trechcinski] At the moment we actually lack money for new developments, not only for scientific-research work but even for design work and system development work. This year we have had much difficulty finding financing sources. Financing limitations are quite significant, as much as 50 percent. Meanwhile, even though CAMAC will continue to function for many years, we must think about its successor right now. In principle, 1982 will be a year which we will dedicate to observing carefully that which is going on in the world. We expect that some sort of successive world standard will appear. When this happens, we must invest at once, otherwise we will not maintain our markets, even the CEMA market.

New Association of Computer Enterprises

Warsaw PRZEGLAD TECHNICZNY in Polish No 4, 4 Jul 82 p 26

[Article: "A New Association of ZETO [Main Center of Electronic Computer Euqipment] Enterprises"]

[Text] On 23 April 1982 the directors of the Center for Information Science Design and Applications, the Informatio Technical Trade Enterprise, headquartered in Warsaw, and the directors of the ZETO plants in Bialystok, Bydgoszcz, Gdansk, Katowice, Kielce, Koszalin, Krakow, Jelenia Gora, Lublin, Olsztyn, Poznan, Rzeszow, Szczecin, Walbrzych, Wroclaw and Zielona Gora signed an agreement uniting the enterprises. ZETO Lodz is not included

because its retiring director did not want to make such an important decision for his successor.

The association will be of a coordinative nature, and its primary task is to organize and coordinate activities beyond the equipment, financial and personnel capabilities of the individual enterprises, and also to act in matters that are common to all association members regarding the authorities and the biggest customers (NBP [Polish National Bank] and ZUS [Social Security Agency]). The association will facilitate the conduct of joint research and development work, the exchange of software, the undertaking of joint investment projects and the determination of prices, as well as the forming of program teams to resolve complex and important tasks.

Fears are often being expressed that the association will degenerate into a creature of the old type associations. The Interim Statute on the Association of ZETO Enterprises contains many conditions guaranteeing the independence of the individual enterprises. The statute states that "the association does not have the right to direct or control association members." The association which requires a financial commitment from the enterprises, is voluntary. A lack of agreement and the noncontribution of payments merely signifies the exclusion of the association member from a given undertaking. The introduction of important changes in the Statute of Association permits members to leave the association without a termination period.

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CSO: 2602/23

END

JPRS 82224

12 November 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 759

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12 November 1982

EAST EUROPE REPORT
SCIENTIFIC AFFAIRS

No. 759

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TEXTBOOK COVERS CHEMICAL, BIOCHEMICAL METHODS OF ANALYZING TOXIC AGENTS

West Berlin LEHRBUCH DER MILITAERCHEMIE in German 1977 (signed to press 15 Feb 76) Vol 2 pp 299-400; 403-480

[Chapters 28 and 29 from "Textbook of Military Chemistry. Vol 2: Sabotage and Plant Poisons, Detoxification and Detoxification Agents, Analysis of Chemical Warfare Agents and Poisons," by Maj Siegfried Franke, chemical engineer (chapters 14-19, new version of chapters 20-23); Peter Franz, chemical engineer (chapters 24-33); Prof Dr Gerhard Gruemmer (collaboration on chapters 17-19); and Lt Col Werner Warnke, chemical engineer (chapters 20-23), VEB Military Publishing House of the German Democratic Republic. A translation of the tables of contents and chapters 14, 15, and 16 from this textbook is published under the heading, "Textbook Covers Toxic Agents, Decontamination," in JPRS 81435, 3 Aug 82, No 750 of this series, pp 2-53]

[Text] 28. Chemical Methods for Analysis of Toxic Agents

In this chapter we describe chemical analysis procedures which make it possible qualitatively and quantitatively to determine warfare agents and sabotage toxins in the various sample materials. The methods vary in terms of their capacity (selectivity, sensitivity, accuracy, time requirement, range of application) and so do the requirements which have been established for the analyst's skill level and the laboratory's equipment.

The analysis and determination methods are essentially described in the sequence customary in the practical implementation of warfare agent analysis in field laboratories. This arrangement of the analytical part, which deviates from the arrangement of Volume I, is practical also for other reasons. If we had followed the pattern used in Volume I, the necessarily separate treatment of the analysis system involved in skin-damaging and throat-irritating arsenic warfare agents would have restricted the clarity of the presentation.

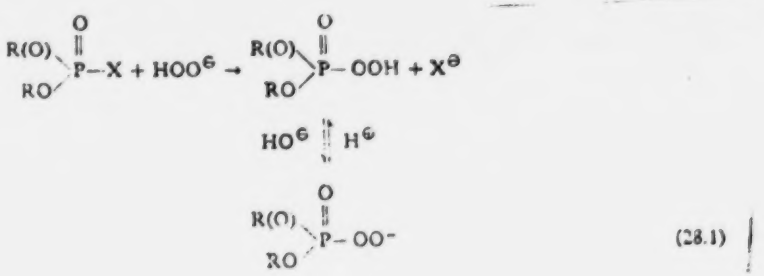
28.1. Organic Phosphorus Compounds

The fact that toxic warfare agents and the most important insecticides are to be found among the representatives of this group of compounds led to a constant search for ever more sensitive analysis and determination methods, as we can see from the wealth of literature available on this subject.

28.1.1. Qualitative Analysis Methods

28.1.1.1. Schoenemann Reaction

This reaction of organic phosphorus compounds, which is still used today in many instances, was discovered in Germany by Schoenemann (21) in his work on trilon warfare agents back in 1944. It is based on the idea that, during the reaction of phosphorus organyls with hydrogen peroxide, intermediary peroxyphosphoric acids are formed in the alkaline medium which, in an alkaline solution are in a state of balance with the perphosphonatanion which quickly oxidizes certain aromatic amines into stained products. According to investigations by Larsson (22), this conversion can be explained in analogy to alkaline hydrolysis in terms of a nucleophile attack of the perhydroxide ion upon the P = O bond. The actual formation of a peracid was proven by Gehauf (23) through the oxidation of thiosulfate into sulfate by means of the reaction mixture; in the meantime, Hilgetag has isolated peroxyphosphoric acid esters.



(28.1)

It has been established that the reaction of the phosphororganyl with hydrogen peroxide takes place about 50 times faster than alkaline hydrolysis. This observation can be explained in terms of the intermediary formation of a hydrogen bridge between the perhydroxide ions and the P = O bond as a result of which the dissociation of the P-X bond is made easier. This speed difference can be clearly seen in Table 28.1 given by Marsh and Neale (24).

Table 28.1. Stability of Sarin in Connection with Various pH Values and with the Addition of Hydrogen Peroxide (temperature 25° C)

Buffer	pH Value	Half-life ($t_{1/2}$ in hrs Without H_2O_2	With 0.1% H_2O_2
HCl/KCl in water/acetone (1:)	1.2	1.7	1.7
Aqueous acetate solution	5	6.7	6.3
Aqueous bicarbonate solution	7.4	8.0	1.4
Aqueous phosphate solution	8.4	1.4	0.2
Phosphate in water/acetone (1:1)	8.4	2.5	0.5
Phosphate in water/acetone (1:1)	11.0	6.5	1.8 (seconds)

Composition of phosphate buffer: 0.5 m K_3PO_4 + 0.01 m KH_2PO_4.

This table also shows the ineffectiveness of hydrogen peroxide in an acid environment. Similar to the differences in the hydrolytic stability of the phosphororganyls, there is also a difference in the speed of the conversions of various compounds with the perhydroxide ion. This is to be shown clearly by three second-order speed constants (at 25° C) given by Marsh and Neale (24) for various types of organic phosphorus compounds.

Sarin	$0.94 \cdot 10^5$ 1 · mol^{-1} min^{-1}
Tetraethyl pyrophosphate (TEPP)	$2 \cdot 10^3$ 1· mol^{-1} min^{-1}
Paraoxon	14 1· mol^{-1} min^{-1}

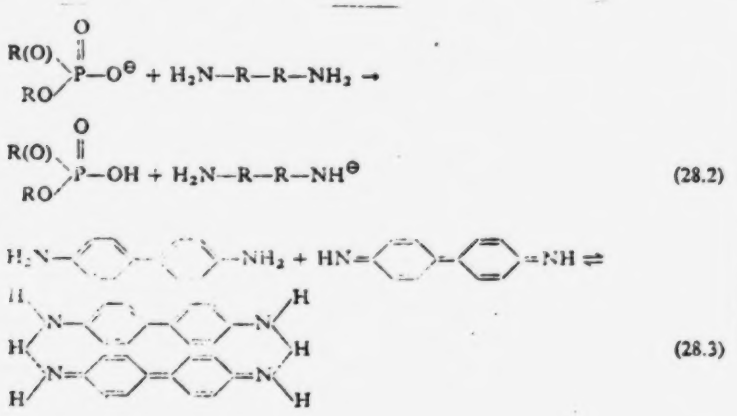
In the light of these values we can estimate that the sensitivity of the reaction in case of application to paraoxon is not great and that indeed is the case. On the other hand, in case of phosphoroganyls with low hydrolytic stability or when we work in the more strongly alkaline range (above pH 12), hydrolysis appears with a disturbing effect as a competitive reaction. It is thus not possible to determine the easily hydrolizable dihalogenides of the phosphoryl compounds or of the fluorphosphonic acid cholinesters with the help of the Schoenemann reaction. In contrast to that, when we use the very slowly hydrolyzing V-substances [mass-destruction warfare agents], measures are necessary to speed up the reaction, for example, an increase in the temperature to a maximum of 40° C. A temperature increase by 10° C increases the speed of the reaction between the phosphororganyl and the peroxide by about factor of 2.5.

In general we can say that, to achieve maximum sensitivity, the conditions during the reaction must be adapted to the phosphororganyl which is to be analyzed. One can keep the pH value low to suppress the hydrolysis but one must then accept an increase in the time until the staining maximum has been reached. This considerable extension in terms of time--which above all takes place in conjunction with slowly reacting compounds, such as DFP, can be made up through an increase in the hydrogen peroxide concentrations but the latter must not be selected so high that there will be a noticeable oxidation of the amine alone due to the peroxide. The optimum conditions are as follows:

pH value	9-9.5
Peroxide concentration	0.01-0.1%
Amin concentration	4 mol/mol phosphororganyl.

We will now turn to the second part of the Schoenemann reaction, that is, the oxidation of the amines. So far, nothing has been published on the kinetics of this reaction; concerning the type of developing reaction products, there are various, hitherto not reliably proven interpretations. Marsh and Neale (24) noted that the absorption spectra of the oxidation products of o-dianisidine in the case of the Schoenemann reaction agree with Sarin and that the oxidation products agree with the alkaline ferric cyanide solution or with potassium permanganate but that on the other hand there are deviations in the properties of the staining products (extractability, change in stain when acid is added). The authors assume that the dye here is a complex made up of quinone diimine and unaltered amines. The origin of quinone diimine can be explained in terms of the prior formation of semiquinone imine when a proton

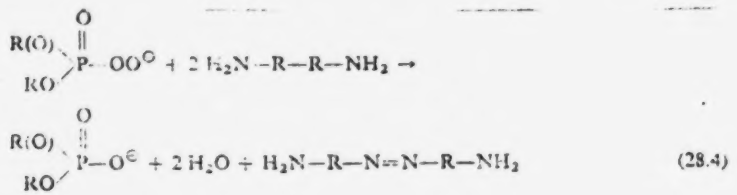
of the amine base is given off to the phosphorus-containing radical. The semiquinone imine radical, which is unstable in alkaline solution, then either forms quinone diimine due to the loss of a second proton to another phosphorus-containing radical or diimine and the original amine will develop due to the disproportioning action of two molecules.



(28.2)

(28.3)

The formation of an azodye stuff is another possible explanation of the staining products.



(28.4)

It has been found (22) that the absorption spectrum of the oxidation product of benzidine is very similar to the spectrum of diaminoazobenzol but was not identical to it. Aksnes and Sandberg (25) oxidized benzidin and O-dianisidine with peracetic acid and investigated the oxidation products. In the case of benzidine, they found 4-amino-4'-ditrodiphenyl as the only oxidation product and in the case of o-dianisidine, on the other hand, they found three products:

I. 3,3'-dimethoxy-4-amin-4'-nitrodiphenyl (yellow, λ_{max} 370 nm)
II. 3, 3'-dimethoxy-4-amino-4-nitrosodiphenyl (brown, λ_{max} 445 nm)
III. Bis (3,3'-dimethoxy-4-amino)-azodiphenyl (red, λ_{max} 435 nm).

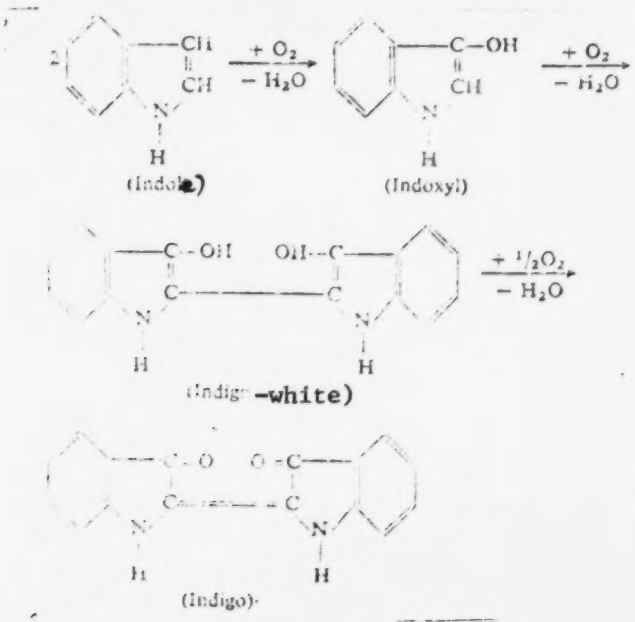
Compound 3 would seem to be the reaction products between the nitroso compound II and o-dianisidine.

In addition to the previously mentioned aromatic diamines called benzidine and o-dianisidine, we can also use o-tolidine for the colorimetric performance of the Schoenemann reaction. As the oxidation agent we use, in the simplest case, an alkaline hydrogen peroxide solution but some peracid compounds, such as sodium proborate, sodium pyrophosphate peroxide, and urea peroxide

are stabler and by virtue of their partly alkaline reaction eliminate the need for the additional use of a buffer.

Acetone is especially suitable as solvent; it reveals a sensitivity-increasing effect which so far has not been clearly explained. The less volatile solvent hexanediol-(1,6), isopropanol, diethylphthalate, and tetraline are better suited for the absorption of the warfare agents in washing bottles but in that case, about 10 percent acetone should be added to the reaction mixture.

Concerning the practical performance of the reaction it is to be noted that, quite naturally, the sequence and the manner in which the reagents are combined will decisively influence the sensitivity. The best results in quantitative determinations are obtained when the sample solution is added drop by drop to the freshly prepared mixture of the reagents. When we add the reagent to the sample solution, we must either add the phosphororganyl sample to a mixture of alkaline peroxide solution with the amine or we must add the alkaline peroxide solution to the mixture of the sample solution with the amine. Under most circumstances may peroxide be added before amine. Perphosphonic acid would react with the peroxide surplus and would here be decomposed along with the development of oxygen. The result would be a considerable sensitivity loss. An increase in sensitivity is achieved if, instead of the previously mentioned amines, we add indole (26) whose oxidation at pH values of around 9 via heavily green-blue fluorescingindoxyl and indigo-white leads to blue indigo.



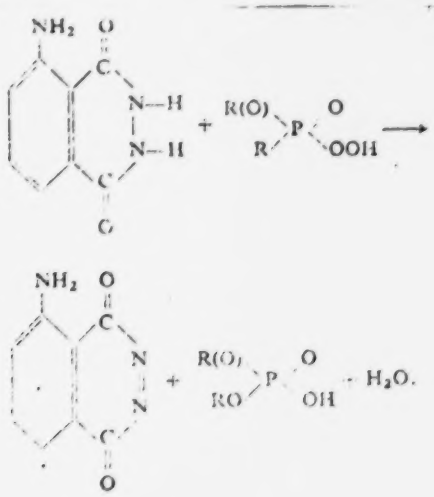
(28.5)

The peroxyphosphoryl compound here causes oxidation all the way to indoxyl; the oxidation continues rather easily due to the oxygen from the residual peroxide. The presence of indoxyl was proven through the addition of isatin to the reaction mixture and the formation of indirubin which was observed in the process; its illustration in this fashion was described in the literature on the subject.

In addition to the measurement of the fluorescence, the blue color of indigo is also analyzed in this modification of the Schoenemann reaction, for example, in the American indicator vials for nerve gases. For a more convenient measurement of the fluorescence, it is possible to stablize the fluorescing products by adding acetone of glycerine.

Another modification of the Schoenemann reaction is the evaluation of the green-blue chemical luminescence which appears upon oxidation of luminol (3-aminophthalic acid hydrazide) (28).

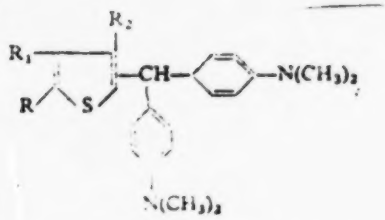
In the investigations conducted by a Yugoslav research group, it was found that chemical luminescence in the case of Sarin reveals two maximums, the first of which briefly takes us back to the above reaction while the second, longer-lasting maximum is caused by the oxidation of luminol through the oxygen developed during the reaction of perphosphonic acid with excess peroxide (16). The addition of alkali halogenides increases the sensitivity, presumable due to the intermediary formation of hypohalogenite (31).



(28.6)

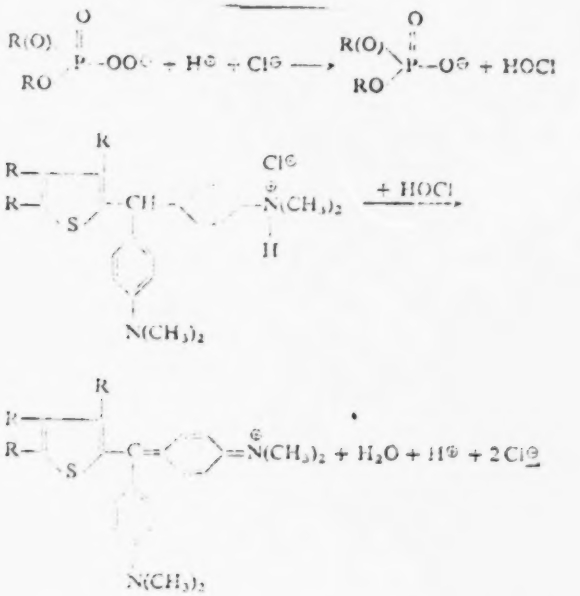
The boundary concentration (about 0.5 µg/ml) is higher than in the case of the fluorescence modification. Tabun can be determined with good sensitivity (0.1 µg/ml) through a similar method, using the chemical luminescence indicator luzigenin (N,N'-Dimethyldiacridiniumdinitrate) (32). The measurement of the weak chemoluminescence light in case of quantitative determinations is possible with secondary electron multipliers.

Here it is interesting to take a look at the work of a Canadian research team whose members, searching for redox indicators suitable for the Schoenemann reaction, encountered some triaryl methane compounds which have a high extinction coefficient and favorable redox potential (-0.7 to 1.0 V) (29).



(28.7)

The best suited compound was made with R = R_1 = CH_3 and R_2 = H 4,4'-4,5-dimethyl-2-thenylidene-bis-N,N-dimethylanilin. An interesting aspect in the case of these indicators is the fact that the oxidation, in contrast to the performances of the Schoenemann reaction described so far, must take place in an acid environment and that the presence of chloride ions is therefore necessary. It is therefore assumed that the indicator is oxidized by hypochloric acid which develops during the acidification due to the reaction of the peroxyphosphoryl with the chloride ion.



We therefore work in the following manner: the phosphororganyl is allowed to react for about 30 sec with an alkaline peroxide solution (pH 10.5) and we then add a solution of the leuco compound of the indicator in diluted sulfuric acid containing sodium chloride. With a pH value of 1.6, we then, up to a boundary concentration of 0.1 µg Sarin/ml, get a blue stain which is better suited for visual recognition than the yellow-orange coloration obtained when we use o-Dianisidin. Tabun produces negative results, probably due a reduction to the peroxyphosphororganyl ions due to the cyanide ions in alkaline solution.

The Schoenemann reaction is a group reaction. In addition to the phosphororganyl, all compounds, which give us peroxide compounds with hydrogen peroxide, react here. Thus we see that aldehydes, acid halogenides, acid anhydrides, and

arylsulfonylhalogenides reveal a similar reaction. This can be used for the determination of these substances, for example, the acylcholin compounds or diphosgene and in connection with their employment as model substances. Thus, p-chlorobenzolsulfonylfluoride is used as a slightly toxic standard substance for the plotting of calibration curves and benzolsulfochloride is a good imitation agent for Sarin.

On the other hand however we must watch out for the disturbing influence of these compounds, especially the aldehydes contained in alcohols and in acetone; this disturbing influence must be eliminated prior to the use of these solvents for the analysis and determination of the phosphororganyls by means of special purification methods.

A similarly disturbing effect also springs from some cations which under certain circumstances are present in water samples; these are cations, such as copper, iron, and manganese; they must be masked by adding complex forming agents such as sodium hexametaphosphate. Disturbances due to heavily oxidizing and reducing decontamination agents must be prevented by means of corresponding preliminary treatment of the sample.

The Schoenemann reaction is used in indicator tubules [vials] for Sarin, in the American nerve gas detectors, in warfare indicators, and in various analysis and determination methods in portable and mobile field laboratories. The range of application of the Schoenemann reaction also extends to the analysis and determination of insecticide phosphoric acid esters, among others, Systox, DDVP, Dipterex, Diazinon, Phosphamide, Rogor, and Dimethoate.

We will confine ourselves to the following description of two analysis methods because we can naturally also use for the analysis the methods given for quantitative determination (see Section 28. 1.2.1.).

Staining Reaction (23)

Reagents:

Solution A (2.5-percent solution of benzidine in acetone)
Solution B (0.25-percent solution of sodium perborate in water, solution must be made fresh everyday!)

Operating Procedure:

To a mixture of 0.5 ml of solution A and 2 ml of solution B we add 2 ml of sample solution in i-propanol or water. Organic phosphorus warfare agents become visible by means of a yellow stain that reaches its maximum after about 20 minutes.

Boundary Concentration

The boundary concentration is at 1-2 µg/ml. The sensitivity can be increased if the stain is shaken out with benzene, toluene, or xylene. When we use an alcoholic sample solution, we must, prior to extracting the dye, dilute with a water. It is a good idea simultaneously with the sample to set up a

blank test with the same quantities of reagents and i-propanol or water and to observe the results.

Spot Reaction (332)

Reagents:

Solution A (0.02 g o-dianisidindihydrochloride are dissolved in 10 ml of methanol and 15 ml of water. To this we add five drops of 5 N sulfuric acid and 4 ml of 25-percent hydrogen peroxide solution. The reagent is stable for 12 hours.)

Solution B (potassium-sodium-carbonate, 3-percent in water).

Operating Procedure

One drop of solution A is placed in the depression in a spot [drop plate] and is mixed with one drop of solution B. After adding a drop of the sample solution, a red stain reveals the presence of organic phosphorus warfare agents of the type of Sarin.

The spot [drop] reaction can also be performed on filter paper.

Boundary Concentration:

The recording limit is at 0.1-0.5 µg.

Fluorescence Reaction (26)

Reagents:

Solution A (indole, 1-percent in aceton)
Solution B (sodium perborate, 25-percent in water)
Solution C (glycerin, 1-percent in water).

Operating Procedure:

A mixture of 2 ml of solution A, 1 ml of solution B, 3 ml of solution C, and 3 ml of acetone is added to 1 ml of sample solution and is immediately observed in the light of an UV lamp. A blue-green fluorescence reveals the presence of organic phosphorus warfare agents in the sample solution.

Boundary Concentration

The boundary concentration is at 0.05-0.1 µg/ml. In concentrations of more than 1 µg/ml, the solution is stained blue-green after a short time. Because of its significance in the success of the analysis, we will now describe the special purification of the solvents and amines which are needed for the Schoenemann reaction.

Acetone

Acetone is treated with potassium permanganate for the oxidation of the aldehydes. We add about 4-5 g $KMnO_4$ for 1 lit and allow the mixture to boil for several hours in the reflux. After that we filter and the acetone is distilled, in connection with which we discard the first 5 percent of the distillate down to a residue of 5 percent.

Alcohols

To eliminate the aldehydes, the alcohol is boiled for 1 hour in the reflux after addition of 1 g benzidine or o-dianisidin for 1 lit and it is then distilled. After adding 1 g oxalic acid, we distill once again. All solvents used are in each case tested for their suitability for the Schoenemann reaction by setting up a blank test which must not reveal any coloration.

Amines (33)

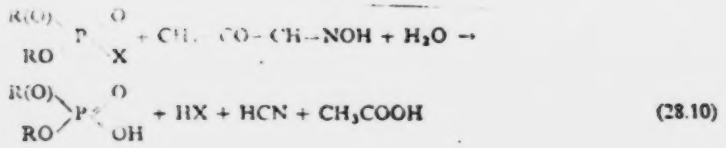
We dissolve 50 g of the raw amine (benzidine, o-tolidine, or o-dianisidin) in a mixture of 35 ml of 85-percent hydrazine hydrate and 500 ml of 95 percent ethanol. Then we add 10 g powdery activated carbon and 6 g sodium bisulfite and we heat and stir for another 2 minutes. The hot solution is filtered and the filtrate is mixed with 1.5 lit of cold, distilled water. The precipitated white amine is filtered off, it is washed with 100 ml of water, and it is dried in the vacuum exsiccator over phosphorus pentoxide. The amine should look white, otherwise the purification process must be repeated.

o-Dianisidindihydrochloride (34)

Industrial o-dianisidinbase is purified according to the above directions and by means of repeated recrystallizing from ethanol, adding activated carbon, until the substance is white. We dissolve it, through cooling in ice, until saturation in acetone and, amid constant cooling, we introduce dry hydrogen chloride gas. The precipitating hydrochloride is filtered off, it is washed with cold acetone and it is then dried. After that it is ground into a powder and once again washed with acetone. The substance must look pure white and must be kept in a bottle made of brown glass or in the dark.

28.1.1.2. Reaction with Oximes

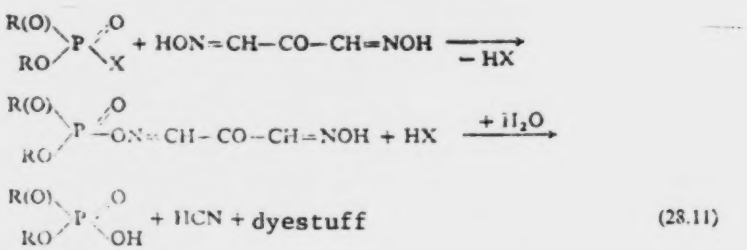
During studies on the reaction between various oximes and organic phosphorus compounds, which were conducted during the search for suitable decontamination agents and antidotes in the United States and Great Britain, several analytically usable conversions [reactions] were also found. Saville (35) found that monoisonitrosoacetone can quickly and completely hydrolyze certain organic phosphorus compounds through nucleophile attack upon the phosphorus atom and is decomposed into hydrocyanic and carboxylic acid.



(28.10)

Other acylizing compounds, such as acid halogenides, also react in an identical manner. By converting the hydrocyanic acid formed with chloramin-T into cyanogen chloride and its staining reaction with pyridin-pyrazolon (36), it is possible to determine phosphororganyls colorimetrically.

Sass, Fischer, and their associates (37, 38) found that, in the reaction of phosphororganyls with diisonitrosoacetone, a red-violet polymethin dyestuff of hitherto unexplained structure is formed.



(28.11)

The optimum pH value for this reaction is 8.3-8.6; in this range, we also reach a maximum in the staining in connection with Sarin within 7 minutes. When we use monobasic salts of diisonitrosoacetone (sodium salts or monoamino-salts of dibutylamine or guanidine) we do not have to add a buffer solution for the adjustment of the desired pH value. The advantage of this reagent resides in the easy handling and the manifold application possibilities. For example, monoamino-salts or multibasic sodium salts can be made into tablets or they can be filled into gelatine capsules to evidence organic phosphorus compounds in water. Using penta-sodium salt, we can make analysis pins for determination in air. The quantitative determination is made by measuring the stain in the colorimeter at 486 mn or 580 mn.

Analysis with Diisonitrosoacetone (37)

Reagents

Diisonitrosoacetone solution, 0.4 percent in water; buffer solution of pH 8.4 (to 500 ml of 0.1-molar boric acid, we add about 17 ml 0.5-molar caustic soda or we use a freshly prepared 2-percent sodium bicarbonate solution).

Operating Procedure

To 1 ml of acqueous or alcoholic sample solution we add 1 ml diisonitrosoacetone solution and 3 ml of buffer solution. Organic phosphorus warfare agents are indicated by a red-orange to red-violet stain.

Boundary Concentration:

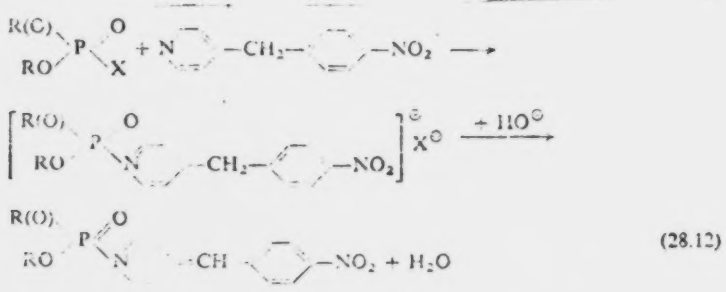
Sarin, Soman, Tabun, and DFP are detected here up to a boundary concentration of 0.25-1 µg/ml.

Irregularities

Methylphosphoryldichloride, phosphoroxychloride, and similar compounds, acylating compounds, such as acetic anhydride, as well as benzene sulfochloride and benzoylchloride under corresponding conditions produce identical stains. These substances will not cause any disturbances in field tests but in handling water samples it is necessary to watch out for the absence of cations (iron (II), copper) and free halogens which if necessary must be masked or eliminated.

28.1.1.3. Reaction with 4-(p-Nitrobenzyl)-pyridin (p-NBP)

This reagent very generally reacts with alkylating compounds, including many warfare agents and with phosphorylating compounds (39). According to a reaction whose course is assumed as follows, p-NBP, with some organic phosphorus warfare agents, such as Sarin, Soman, and Tabun, forms a blue stain whose absorption maximum is at 625 nm (40).

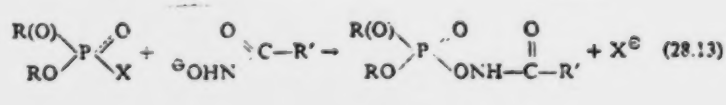


(28.12)

In spite of its disadvantages, which reside in the low specificity and the low sensitivity in the case of phosphorus-containing warfare agents (25-75 µg/ml), we can say that this analysis method in field analysis is important as a preliminary test for the presence of toxic agents. The analysis is performed along the lines of the methods described in connection with the determination of nitrogen yperites (see Section 28.3.2.2.).

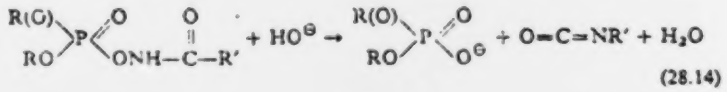
28.1.1.4. Reaction with Hydroxamic Acids

In this reaction, which takes place in a slightly alkaline medium, there is furthermore--after polarization of the P = O bonds--a nucleophile substitution reaction of the hydroxamic acid anion.

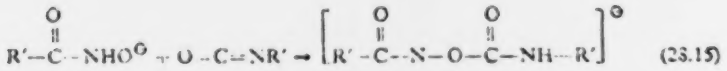


(28.13)

This unstable phosphorylation product is decomposed amid Lossen transposition [rearrange ent] (41) into isocyanate which reacts with another hydroxamic acid ion toward the corresponding carbamyl hydroxamate.



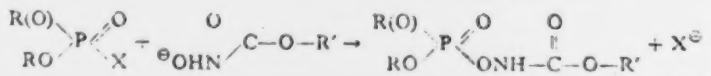
(28.14)



(28.15)

The reaction with benzhydroxamic acid yields phenylcarbamylbenzhydroxamate, which thermally can be decomposed into anilin. In the acid medium, we get an azomethin dye due to reaction with p-dimethylaminobenzaldehyde so that, due to the course of this reaction, for example, Sarin can be detected up to a boundary concentration of 0.4 mg/ml (42).

If the phosphororganyls at pH 8 are transformed with N-Hydroxy-arlycarbamates, then stable phosphorylation products are formed (43) which can be precipitated by means of the acetification of the reaction mixture and which can be used to identify the organic phosphorus compound.



(28.16)

The illustration of these derivatives can be accomplished in an aqueous medium or, in case of slightly hydrolyzing compounds, in pyridine. To a solution of 1 g N-hydroxyphenylcarbamate (0.0065 mol) in 50 ml of water, we add 0.045 mol of the phosphororganyl compounds. The pH value is kept at 8 through the corresponding addition of 0.2 normal caustic soda. If no further acid formation can be observed, we acetify with hydrochloric acid (pH 3) and we filter the white precipitate. After drying and recrystallizing, we determine the melting point. In case of lighter water-soluble phosphorylation products we extract after acetification with chloroform, we dry with magnesium sulfate, and after restriction through the addition of Ligroin (boiling point up to 80° C), we precipitate. The melting points of the phosphorylation products of some organic phosphorus toxins are as follows:

Sarin 137-139" C, recrystallized from methylenechloride/Ligroin
DFP 122-124° C, recrystallized from chloroform/Ligroin
TEPP 65-66° C, recrystallized from chloroform/petroether.

28.1.1.5. Detection of VX

For the special protection of organic phosphorus warfare agents of type V, there are two possibilities in addition to the use of general methods:

(a) Detection of thiol sulfur, mostly after hydrolytic cleavage of the molecule;

(b) Detection of tertiary nitrogen in the S-diisopropylaminoethyl group with Dragendorff's reagent.

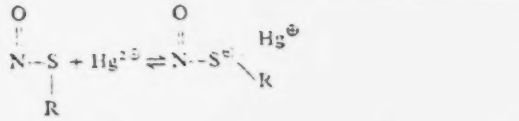
The two detection methods, described below, are particularly useful in the sensitive determination of thiol sulfur. The first detection method is a modification of a colorimetric micro-determination for thiols described by Saville (51). The stained product is formed according to a rather interesting reaction mechanism whose step is the already rather well-known conversion [transposition] of thiol with nitrous acid into nitrosylmercaptide.

$$R\text{--}SH + HONO \rightarrow R\text{--}S\text{--}NO + H_2O \qquad (28.17)$$

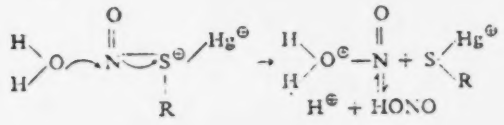
The excess nitrous acid is destroyed by amidosulfo acid in whose presence the nitrosylmercaptides are rather stable.

$$HONO + NH_2SO_3NH_2 \rightarrow NH_4HSO_4 + N_2 + H_2O \qquad (28.18)$$

After that, nitrosylmercaptide is hydrolyzed by mercury (II)-salt. This rapid hydrolysis can be explained in terms of the formation of a complex as a result of which the N-S bond becomes sensitive to the nucleophile attack of the water molecules and is split.

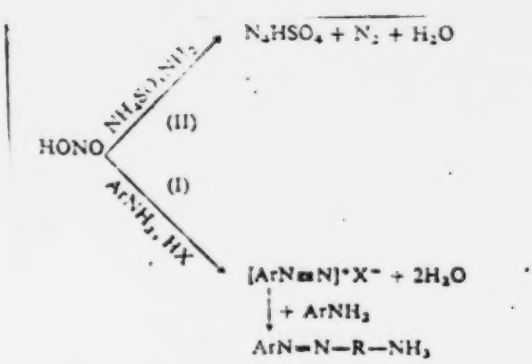


(28.19)



(28.20)

The nitrous acid released here will diazotize sulfanilamide (I); the diazonium salt is coupled with α-naphthylamine or another aromatic amine into an azo-dye. The competing reaction of nitrous acid with the amidosulfo acid present in the reaction mixture (II) essentially takes place more slowly and does not disturb the formation of the stain.



(28.21)

Reagents:

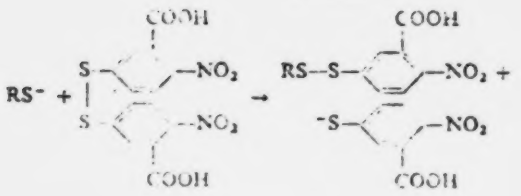
Solution I: Sodium nitrite, 0.03-percent, in water
Solution II: Amidosulfo acid, 2-percent, in water
Solution III: Mixture of:

1 part by volume 2-percent aqueous mercury (II)-chloride solution
4 parts by volume, 3-percent sulfanilamide solution in 2-percent hydrochloric acid
5 parts by volume, 0.1-percent solution of naphthylethylenediamindihydrochloride, 2-percent hydrochloric acid.

Operating Procedure

We heat 5 ml of the aqueous solution with 0.5 ml of 5 normal caustic soda in a ground-top reagent glass for 5 minutes in a water bath at 80° C. Then we add 1 ml of 5 normal sulfuric acid, we cool quickly, and we mix with 1 ml of solution I. One must avoid wetting the ground area with the solution as much as possible. After 1 minute we add 1 ml of solution II and we put the reagent glass vessel into the water bath after inserting the stopper and after shaking forcefully for 8 minutes. After we take it out, we once again shake forcefully, we slightly lift and turn the stopper so that the hot solution will thoroughly wet the ground surface along the glass and the stopper. Then we cool and we mix with 2 ml solution III. A red-violet stain, visible after several minutes, indicates thiolphosphoric acid esters up to a boundary concentration of about 0.1 µg/ml. If we use the same operating procedure, we can make the quantitative determination in that the stain obtained after 5 minutes is measured in the spectral photometer at 535 nm and we analyze with the help of a previously plotted calibration curve. For detection in alcoholic sample solutions, we mix 4 ml of the sample with 1 ml of water and 0.5 ml of 5-normal [standard] caustic soda and we heat for 15 minutes in a boiling water bath. Then we must add 4 ml of water and 1 ml of 5-normal sulfuric acid and, after cooling, we continue to work as described for the aqueous sample solution.

The thiol test with 5,5'-Dithio-bis-(2-nitrobenzoic acid) (52) used for the histochemical analysis of SH groups is of lesser sensitivity but very simple to perform. This water-soluble reagent (Elimann's reagent) reacts with thiols at pH 8, forming mixed disulfides and releasing the anion--which has an intensive yellow stain in the alkaline medium--of 5-thio-2-nitrobenzoic acid.

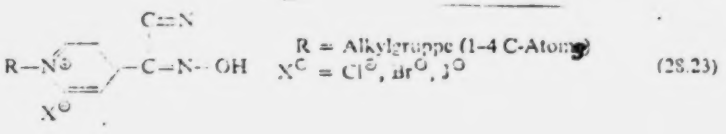


(28.22)

Bis-(p-Nitrophenyl)-disulfide (53) reacts in a similar manner but we must then work in acetonic-aqueous solution because of the low water solubility of this compound. Other stain tests of the hydrolytically split thiol can be performed with nitroprussid sodium, phosphorus-18-tungstic acid, 2,6-dichlorphenol-indophenol and triphenyltetrazolium chloride.

The detection of the tertiary amino nitrogen can be accomplished with the Dragendorff reagent or with phosphotungstic acid.

We get a specific staining reaction with organic phosphorus warfare agents of the type VX from oximes with the following general formula (328):



(28.23)

Key: Alkylgruppe--Alkyl group.

In case of contact with V-warfare agents, these oxides reveal a color change from orange to blue, followed by red fluorescence in UV light. The compounds, which are also stable against the effect of light, are supposed to be particularly suitable for use in reference styluses, detection powders, and detection sprays.

Acetate-covered mixed polymerisates of chloral and dichloracetaldehyde are decomposed by various amino-nitrogen-containing compounds, including V agents (329).

This decomposition is made visible by dissolving the dye pinacyanol in the chloracetaldehyde formed. The detection system is particularly suitable for indicator vials.

28.1.1.6. Qualitative Differentiation of Organic Phosphorus Warfare Agents

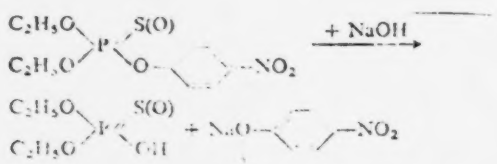
The differentiation of organic phosphorus warfare agents can be accomplished with the help of the above-described detection methods and the analysis of certain functional groups and elements. The following overview is designed to facilitate the analysis of the results obtained.

To begin with, the presence of an organic phosphorus warfare agent is determined through enzymatic detection with a general chemical analysis method, for example, the Schoenemann reaction.

We have:	In case of positive evidence of:
1. DFP	(a) Fluoride, after decomposition with sodium ethylate (b) Phosphate, after decomposition with strong caustic soda (c) O-isopropyl group with p-Dimethylaminobenzaldehyde-sulfuric acid
2. Tabun	(a) Cyanide, after decomposition with caustic soda (b) Dimethylamino group with Dragendorff reagent
3. Sarin	(a) Fluoride, after decomposition with sodium ethylate (b) O-isopropyl group with p-Dimethylaminobenzaldehyde sulfuric acid
4. Soman	(a) Fluoride, after decomposition with sodium ethylate (b) O-dimethylbutyl group with Vanillin-sulfuric acid
5. VX	(a) Dialkylamino group with Dragendorff reagent (b) Thiol sulfur as nitrosylmercaptide after alkaline cleavage (c) O-alkyl group

28.1.1.7. Detection of Paraoxon

The analysis methods described below are equally suited for the detection of the analogous thiono-compond, that is, parathion. The simplest form of detection is based on the acceleration of hydrolysis of this compound due to alkali.



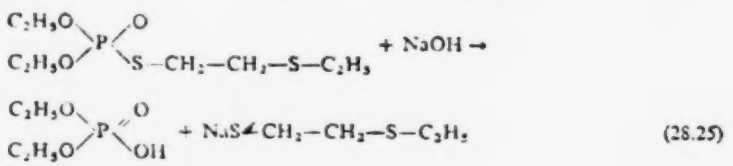
(28.24)

The intensive yellow color of the sodium salts of p-nitrophenol is then considered the analysis [detection] stain. The analysis is performed as follows: we mix 5 ml of the aqueous or alcoholic sample solution with 0.5 ml 20-percent lye and we heat for some time in a boiling water bath, possibly in the reflux. To increase the method's sensitivity, we can add Millon's [illegible in photostat] reagent. About 2-3 µg parathion will still be visible by virtue of a raspberry-red color (45).

The insecticides parathion, paraoxon, chlorthion, and EPN together with diphenylamin in a sulfuric acid solution give us an intensive blue coloration. The reaction mechanism corresponds to the known nitrate analysis.

28.1.1.8. Detection of Isosystox

A possibility of detecting isosystox is based on the ability of thioether-sulfur to form addition compounds with noble metal salts, especially with gold fluoride. These adducts are only slightly stained but are "developed" by chloramine or arylantidiazotate into heavily stained reaction products. This possibility, which now also applies to sulfure yperite, is used in the known systox detection vial by the Draeger Company. A simple performance of this test in the form of a spot test is described in connection with sulfur yperite. Like sulfur yperite, isosystox--if it is heated first of all in an alkaline solution and then acidified--produces a clouding effect with the reagent according to Mayer (HgJ_2-KJ); this clouding effect is visible up to a boundary concentration of 0.02 mg/ml. Other sensitive tests are possible if isosystox is hydrolyzed by heating with alkalis and if staining reactions are performed upon the mercaptan which is formed.



(28.25)

For example, the test can be performed in the following manner: 3 ml of the sample solution are mixed with 0.5 ml of 10-percent caustic soda and are heated to the boiling point. After cooling, we add three drops of a 10-percent nitroprussid-sodium solution. A red-violet stain, which is still recognizable at a boundary concentration of 0.1 mg/ml, indicates the presence of isosystox.

28.1.2. Quantitative Determination

28.1.2.1. Schoenemann Reaction

In the quantitative determination of organic phosphorus warfare agents with the help of the Schoenemann reaction--whose theory was described in detail in Section 28.1.1.1.--various modifications are possible. Some of them--in which differing reagents are used, will now be described in further detail.

Colorimetric Methods

(a) With o-Dianisidin (44)

Reagents:

Buffer solution, pH 11.5 (16 g potassium dihydrogenphosphate and 9 g potassium hydroxide are distilled in 1,000 ml and are dissolved in water free of any carbon dioxide; this solution is mixed with 1:1 purified acetone and is adjusted for a pH of 11,5 with diluted potash lye).

o-Dianisidindihydrochloride, 1.3-percent in water (the solution must be kept in the dark and must be freshly prepared each week!)

Hydrogen peroxide, 1-percent solution

Operating Procedure

We prepare a mixed reagent consisting of 23 parts of the buffer solution, one part o-dianisidindihydrochloride solution, and one part of hydrogen peroxide. This mixture is suitable for the determination of Sarin and Soman; if DFP or tetraethylpyrophosphate are to be determined, we add three parts of hydrogen peroxide solution. The mixed reagent can be kept up to 30 minutes.

Prior to the determination, we plot a calibration curve. For this purpose, we make a standard solution of the phosphorus-containing warfare agent in isopropanol. We use up to a maximum of 2 ml of this standard solution. The dilution series is to be so selected that, in the case of Sarin, those 2 ml--or aliquot (specimen) parts--will contain 0-300 µg Sarin. Aliquot parts in each case are supplemented from a microburet with isopropanol to 2 ml so that the reaction mixture will always contain the same quantity of alcohol.

We placed 20 ml of the reagent mixture into a 25-ml measuring flask and, drop by drop, while constantly mixing, we add the standard solution of the warfare agent within 60-90 sec. Then, if necessary, we supplement with isopropanol and we fill up to 25 ml with additional reagent mixture. At room temperature, the stain can then be measured in case of Sarin and Soman after 10 minutes, in case of DFP after 30 minutes, and in case of tetraethylpyrophosphate, it can be measured after 20 minutes in the colorimeter whose center of gravity is at 450 nm. As comparison solution we use a blank experiment in which, in place of the standard solution, we added 2 ml isopropanol. The extinctions determined for the various concentrations are then plotted in a calibration curve. The actual determination is then performed according to the same method and is analyzed according to the calibration curve.

The method has to be changed if we want to apply it to aminoalkylthiolphosphorus compounds. Satisfactory sensitivity is achieved if we either increase the hydrogen peroxide concentration and if we extend the time until we measure the stain or if the reaction mixture is briefly heated under reproducible conditions. We must of course devote special attention here to the blank experiment. The Schoenemann reaction cannot be used in determining quaternary compounds.

The method can, with minor changes, be adapted to the various tasks, such as the determination of organic phosphorus warfare agents in water or in the air (after absorption in a suitable solvent). The important thing is to make sure that the plotting of the calibration curve is in each case done with a standard solution which has the same composition as the sample solution. The share of the sample solution or the standard solution out of the reaction mixture can be increased to a maximum of 50 percent (12.5 ml), but the time until the attainment of the maximum stain is then extended and it must be determined in advance.

(b) With o-Tolidin (46)

Reagents

Buffer solution, pH 8.7 (1,000 ml of 0.1-molar potassium dihydrogenphosphate solution, 100 ml 1-molar caustic soda, and 1,000 ml of water are mixed and are adjusted for a pH value of 8.7 with 1-molar caustic soda, after which we dilute with water to 2 lit).

O-Tolidinhydrochloride, 1-percent, in water,

Sodium perborate, 1.25-percent, in water (must be prepared fresh daily!)

Operating Prodedure

To a mixed reagent, made immediately prior to use and consisting of 40 ml of purified acetone, 4 ml of buffer solution, 2 ml of o-tolidinhydrochloride solution, and 3 ml of sodium perborate solution, we add 10 ml of the aqueous sample solution. After 20 minutes, the stain is colorimetrized at 420 nm. For evaluation, we use a previously prepared calibration curve.

Fluorometric Method (47)

Reagents:

Solution I (in a mixture of 1,000 ml of water, 100 ml of acetone, and 100 ml of isopropanol, we dissolve 2 g of indol, 3.57 g of sodium bicarbonate, and 0.43 g sodium carbonate)

Solution II (3.5 ml 13.3-percent hydrogen peroxide are added to a mixture of 1,000 ml water and 250 ml isopropanol)

Operating Procedure

To 24 ml of a mixture of solution I and II (1:1), whose pH value should be at 10.6, we add 1 ml sample solution in isopropanol and we immediately determine the maximum fluorescence in the fluorescence photometer. Excitation is accomplished with UV light in the range of 350-400 nm and the maximum of the blue-green fluorescing is 500 nm. Analysis is performed with the help of a calibration curve.

28.1.2.2. Measurement-Analysis Determination of Organic Phosphorus Fluoride Compounds (Hydrolytic Method)

This determination method (48) can be used for checking on the purity of the mentioned phosphorus compounds as an easily handled macromethod. It is based on the difference of the hydrolysis speed of these compounds as compared to that of the impurities, such as phosphorylchlorides and difluorides. In order to distinguish between Sarin and the corresponding pyroester which is possible in the form of an impurity and which has similar hydrolysis properties, we can place the mixture on a water-saturated silicagel acid. The pyroester is retained while the Sarin is washed out with isopropylether and can then be titered.

The pyroester content then springs from the difference with respect to a previously performed overall determination or the pyroester can be separately determined in an aqueous extract. The time for alkaline hydrolysis after addition of caustic soda must be extended to 10 minutes as compared to 2-5 minutes for the Sarin determination.

Another simplified possibility for the separation of Sarin from pyroester is the reproducible distribution (80:20) between an organic solvent (isopropyl-ether) and an aqueous 3.6-percent sodium chloride solution. This separation is less accurate than column separation.

Operating Procedure

A volume of the phosphorus compound, corresponding to 0.13-0.18 g, is placed by means of a microflask pipet into a previously weighed Erlenmeyer flask and the exact weight is determined by means of re-weighing. Then we add 15 ml of water and 4 to 5 drops of a mixing indicator which consists of a solution of 0.05-percent methyl-red and 0.1 percent thymolphthaleine in methanol. More exact although more laborious is the weighing of the warfare agent in a glass ampoule which is then placed in the Erlenmeyer flask that is filled with water and indicator and which is crushed with a glass rod. After the dissolution of the phosphorus compound, we immediately titrate with 0.1-normal caustic soda up to the stain switch from red to yellow.

We note the consumption of caustic soda since it indicates the quantity of free acid and the quantities of acid from the rapidly hydrolyzing impurities. Immediately thereafter, we add additional caustic soda (about 2 ml per 0.01 g of the amount weighed in initially) until the solution takes on a blue color. This lye quantity is also recorded. After 2 or a maximum of 5 minutes, we retiter with 0.1-normal hydrochloric acid until the methyl-red changes color from yellow to yellow-pink. The Sarin content is then computed as follows:

$$\% \text{ Sarin} = \frac{7{,}005 \cdot (a \cdot F_{NaOH} - b \cdot F_{HCl}) \cdot 100}{\text{Einwaage [mg]}} ;$$

Key: Einwaage--Weighed portion.

a--Second consumption of 0.1 n NaOH (ml)
b--Consumption of 0.1 n HCl (ml)

Phosphorus compounds with poor water solubility, such as Soman, are dissolved in ethanol. Then we dilute with water until the alcohol content remains below 20 percent by volume. A higher alcohol content would reduce the hydrolysis speed of the fluorphosphonates.

28.1.2.3. Measurement-Analysis Determination of Organic Fluoride Phosphorus Compounds (Peroxide Method)

Using this method (50), it is possible to determine smaller quantities of fluorophosphonates with the help of the hydrolytic procedure. The method is based on the reaction of these phosphorus compounds with alkaline hydrogen peroxide solution and the iodometric determination of the excess peroxide.

$$H_2O_2 + 2\,HJ \rightarrow J_2 + 2\,H_2O \qquad (28.26)$$

Reagents:

Peroxide buffer solution, pH 10 (8.5-9 g sodium pyrophosphate peroxide, $Na_4P_2O \cdot 2H_2O_2$, and 5.68 borax, $Na_2B_4O_7 \cdot 10H_2O$, are dissolved in 500 ml of water, they are adjusted to a pH of 10 with 10-percent caustic soda (about 12 ml), and they are filled up to 1 lit with water).

Operating Procedure

We weigh 0.18-0.24 g of the toxin in a 100-ml measurement flask in that the toxin is either pipetted in and the quantity is determined by weighing the flask or we use a glass ampoule which has been destroyed by means of a glass rod in the measurement flask previously filled with about 20 ml of 50-percent isopropanol. We fill up to the marker with 50--percent isopropanol. Into two 500-ml Erlenmeyer flasks with ground stopper, one of which is intended for the blank experiment, replace 50 ml, each, of the buffered peroxide solutions. Into one of the flasks we then pipette, while shaking constantly (important!), 20 ml of the sample solution and into the other flask we put 20 ml of 50-percent isopropanol and we allow both flasks to stand for 2-4 minutes while shaking occasionally. Then we add the following to each of the two solutions: 30 ml water, 10 ml 18-normal [standard] sulfuric acid, and 3 g potassium iodide, in this sequence; we mix and we allow the mixture to stand in the dark for 10 minutes. Then the separated iodine is retitered with 0.1-normal sodium thiosulfate solution. Shortly before the disappearance of the yellow iodine color, we add a little start solution as indicator and we titer up to decoloration. We find that 1 ml of the 0.1-normal thiosulfate solution consumed corresponds to 1/4,000 mole of fluorphosphonate. The Sarin content of the sample can then be calculated as follows:

$$\%\,\text{Sarin} = \frac{3{,}502 \cdot (a - b) \cdot F_{Na_2S_2O_3} \cdot 5 \cdot 100}{\text{Einwaage [mg]}};$$

Key: Einwaage--Weighed portion.
a = ml consumption of 0.1 n $Na_2S_2O_3$ for the blank test
b = ml consumption of 0.1 n $Na_2S_2O_3$ for the sample.

Phosphorylchlorides and difluorides do not disturb the determination because they hydrolyze in the aqueous-alcoholic sample solution already prior to the addition of peroxide. The values obtained with this method have an accuracy within 1 percent. A special determination of phosphorylchloride can be made after prior transposition with hydrofluoric acid to the corresponding phosphorylfluorides with the above method.

28.1.2.4. Fast Colorimetric Determination with 4-(p-Nitrobenzyl)-pyridine (p-NBP) (50)

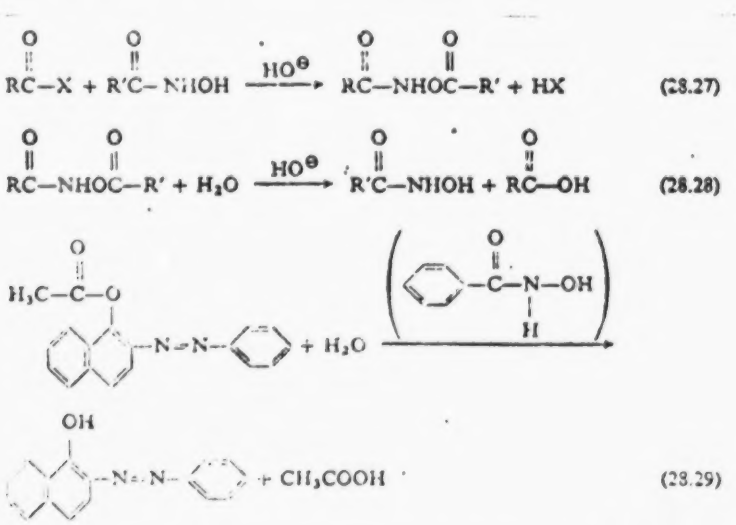
Reagents:

4-(p-nitrobenzyl)-pyridine, 2-percent in acetone; cyclohexylamine, 2-percent in acetone (the acetone needed is purified by means of boiling for 1 hour with 1 g $KMnO_4$ per liter and subsequent distillation.

We mix 0.05 ml of the solution of the toxin in acetone with 0.2 ml p-NBP solution and 0.2 ml cyclohexylamine solution and we heat for 3 minutes in the oil bath on the reflux. After cooling, we fill up with double-distilled ethylacetate to 3 ml and after 10 minutes we colorimetrize at 520 nm against a blank test. The analysis is accomplished by means of a calibration curve which was plotted 2-15 µg of the phosphorus compound.

28.1.2.5. Colorimetric Determination with Hydroxamic Acid

A very interesting detection and determination method for phosphoric acid esters (111) is based on the property of the hydroxamic acid ions to catalyze the hydrolysis of certain acylating compounds.



In this method, we allow the phosphoric acid ester to react with an excess of hydroxamic acid at pH 9 (see 28.1.1.4). The unused hydroxamic acid then catalyzes the hydrolysis of yellow 2-azobenzol-1-naphthylacetate, whereby red 2-azobenzol-1-naphthol is formed. After expiration of a certain interval of time, we stop the hydrolysis by adding acid. The stain intensity of the hydrolysis product is a measure of the original phosphoric acid ester quantity. The similarity to the enzymatic methods described in Chapter 29, based on the inhibition of cholinesterase is obvious but the chemical method is definitely less sensitive.

The optimum conditions for each phosphoric acid ester vary because they depend on the reaction speed of the ester with the hydroxamic acid ion and the hydroxide ion. The following operating instructions apply to Sarin:

Reagents:

$2 \cdot 10^{-3}$ molar solution of hexanehydroxamic acid in water
Buffer (0.001-molar solution of sodium tetraborate with 0.05 normal hydrochloric acid adjusted to a pH of 9).

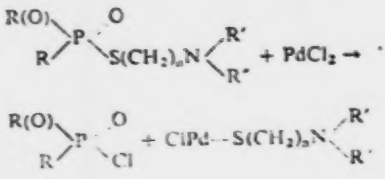
$2.5 \cdot 10^{-3}$ molar solution of 2-azobenzol-1-naphthylacetate in acetone
0.05-normal hydrochloric acid

Operating Procedure

We mix 4 ml of the aqueous sample solution with 1 ml of hydroxamic acid solution and 1 ml of buffer and we allow it to stand for 10 minutes at 25° C. After that we add 4 ml of the substrate solution, we mix, and we transpose after another 5 minutes with 0.5 ml hydrochloric acid. After 2 minutes, we determine the extinction in the spectral photometer at 540 nm. The analysis is performed with the help of a calibration curve. The smallest Sarin concentration that can be determined is 0.5 µg/ml.

28.1.2.6. Photometric Determination of Thiolphosphororganyls (V-Substances) (54)

The determination is based on the fast cleavage of the P-S bond by means of palladium (II)-chloride, with the formation of the corresponding phyosphoryl-chloride and a stable complex compound of palladium with thiol.



(28.30)

The palladium-thiol complex is determined through photometry in the UV range.

Reagents:

Palladiumchloride solution (0.05-molar solution of ammoniumchloropalladite in 0.3-molar hydrochloric acid)

Comparison solution (0.5 ml of the palladiumchloride solution are diluted 0.3-molar hydrochloric acid 50 ml)

Operating Procedure

The toxin is dissolved in water or in a solvent which can be mixed with water and which does not reveal any absorption in the wavelength range applied. Isopropanol is quite suitable here; 0.5 ml of the palladiumchloride solution are mixed in a 50-ml measuring flask with a certain volume of the toxin solution; then we fill up to the marker with 0.3-molar hydrochloric acid. The absorption is measured at 250 nm or 310 nm against the comparison solution.

The analysis is performed according to a calibration curve which was plotted with a standard solution of the corresponding thiol compound. The time until the attainment of maximum absorption depends on the type of thiol compound and must be determined in each case.

This determination method can be used for all thiol compounds which form water-soluble palladium complexes. We can determine concentrations of about 2-200 µg/ml.

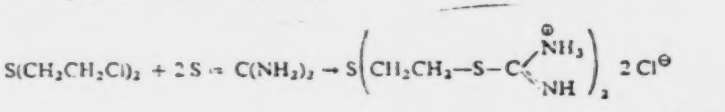
28.2. Halogenated Thioether (Sulfur Yperites)

In accordance with the significance of Bis-(2-chlorethyl)-thioether during World War I, numerous analysis methods were worked out at that time. Because of the development of more sensitive staining reactions, they are today only of minor interest and we can therefore dispense with a detailed description in favor of the modern methods.

28.2.1. Qualitative Analysis Method

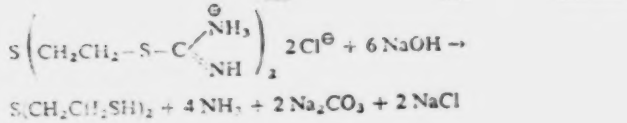
28.2.1.1. Reaction with Thiourea and Nickel Salt

In this reaction, described by Harley-Mason (55), the chlorine atoms of sulfur yperite are replaced with thiol groups and the dithiol is established as red complex compound with nickel.



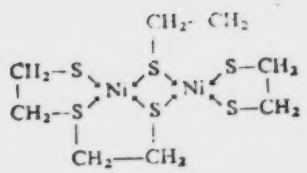
(28.31)

This product is split in an alkaline solution into bis-[ethanthiol-(2)]-thioether.



(28.32)

Dithiol then, with ammonia-alkaline nickel salt solution, gives us a red complex with the following structure:



(28.33)

The performance of the staining reaction was worked out by Matousek and Tomecek (42).

Reagents:

Thiourea, 5-percent, in ethanol
Nickel sulfate (we dissolve 5 g in 50 ml water and we fill up to 100 ml with 20-percent ammonia solution)
Caustic soda, 30-percent
Acetic acid, 50-percent

Operating Procedure

To 1 ml of the alcoholic sample solution we add 1 ml thiourea solution and we heat in a water bath to the boiling point for 2-3 minutes. Then we add 0.5 ml caustic soda and we once again quickly heat to the boiling point. After cooling, we neutralize or we slightly acidify with acetic acid. After adding 0.5 ml nickel sulfate solution, we get a red stain in the presence of yperite; that stain is shaken out after dilution of the sample solution with 1-2 ml of water, with 2-3 ml of chloroform or with dichloroethane. In place of the nickel sulfate solution we can also add 0.5-percent nitroprussid sodium solution with which we get a violet color in the alkaline medium.

Boundary Concentration: 0.04 mg sulfur or nitrogen yperite per milliliter

Irregularities: In the presence of higher concentrations of acetone bromide, chloropicrin, chloracetophenon, methyl- and ethyldichlorarsis, similar stains are obtained after some time.

28.2.1.2. Reaction with Alkaline Thymolphthaleine Solution

This staining reaction, which is equally useful in the detection of sulfur and nitrogen yperites, is based on the following reaction mechanism (see Formula 28.34, above).

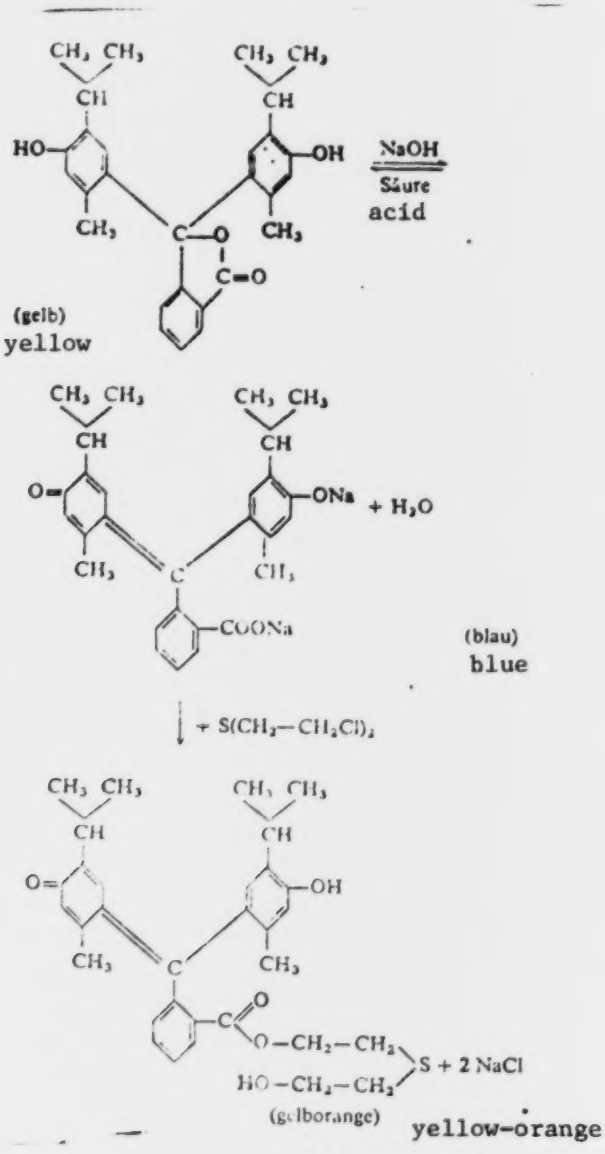
The makeup of this dye, which is stable in acid solution, was confirmed by Matousek and associates (42) through ultrared-spectroscopic investigations.

Reagent:

0.4 g thymolphthaleine are dissolved in 60 ml of pure ethanol and 20 ml of 0.6-percent potash lye are added to the solution. The solution should assume a deep blue color here.

Operating Procedure

To 2 ml alcoholic or aqueous sample solution, we add the same volume of reagent and we heat the mixture for 20 minutes to 80° C in a water bath. We must make sure that the mixture will retain a blue color during heating, otherwise we would have to add several drops of diluted potash lye until the blue color is restored. After cooling, we add one or two drops of acetic acid, whereupon the blue stain will disappear and the solution, in the presence of sulfur or nitrogen yperite, will show a yellow to orange-red stain.



A slight coloration becomes clearly recognizable if we shake out with 1 ml toluene or benzene. When we use an alcoholic sample solution, we must add a little water before shaking out. After adding 1:1 diluted hydrochloric acid to the toluene layer, the coloration of the same will change to red. If we are dealing with nitrogen yperite, the reaction product with thymolphthalein will contain a basic nitrogen atom and the red coloration will move into the hydrochloric acid layer due to the formation of a water-soluble salt. The reaction can also be used for the photometric determination of yperites in that we measure the extinction at 450 nm and analyze with the help of a calibration curve.

Boundary concentration: 0.05 µg sulfur or nitrogen yperite per milliliter.

Disturbances: Halogen-containing aliphatic compounds, such as dichloroethane, acetone bromide, chloropicrin and others produce identical stains.

28.2.1.3. Reaction with Grignard Reagent

The detection reagent described by Grignard (56) contains complex sodium copper iodide which, when combined with copper sulfite and an excess of sodium iodide is formed in aqueous solution:

$$CuSO_4 + 2\,NaJ \rightarrow CuJ_2 + Na_2SO_4 \qquad (28.35)$$

$$2\,CuJ_2 \rightarrow Cu_2J_2 + J_2 \qquad (28.36)$$

$$Cu_2J_2 + 2\,NaJ \rightarrow Na_2Cu_2J_4 \qquad (28.37)$$

During the reaction with sulfur yperite, an insoluble compound of bis-(2-iodine-ethyl)-thioether is formed with copper iodide:

$$Na_2CuJ_4 + S(CH_2-CH_2Cl)_2 \rightarrow S(CH_2-CH_2J)_2CuJ_2 + 2\,NaCl \qquad (28.38)$$

The addition of gum arabic will stabilize the developing clouding.

Reagents:

20 g sodium iodide are dissolved in 50 ml of water and we add 1 ml 7.5-percent copper sulfate solution. After adding 2 ml of a solution of 35 g gum arabic in 100 ml water, we fill up with water to 200 ml and we filter. The reagent must be kept in a flask made of brown glass.

Operating Procedure

We can suction air to be tested through an absorber flask filled with the reagent or the reagent can be added to the aqueous sample solution. The presence of sulfur yperite is indicated by a yellow clouding.

Boundary concentration: 0.05 mg/ml.

Irregularities: The analysis is disturbed by arsines which produce identical clouding. Marbot (57) described a drop test to be performed with the reagents used in the Grignard test.

Operating Procedure

A drop of the alcoholic sample solution is placed on filter paper. After the evaporation of the solvent, we place, in the same spot, a drop of 5-percent alcoholic sodium iodide solution and we dab the latter along the edge with a drop of 10-percent copper sulfate solution. Upon observation in the light of a UV lamp, we note a yellow-green fluorescence in the presence of sulfur yperite along the contact zone of the drop.

Boundary concentration: 0.1 mg/ml.

28.2.1.4. Reaction with Gold Chloride

In the reaction, used for the first time by Schroeter (58) and Obermiller (59) in detecting sulfur yperite, an insoluble addition compound is formed.

$$AuCl_3 \cdot S\begin{matrix}\diagup CH_2CH_2Cl \\ \diagdown CH_2CH_2Cl\end{matrix} \qquad (28.39)$$

Identical deposit compounds are formed with many heavy metal salts but gold and palladium salts are best suited for this analysis. The reaction is well suited for drop tests on paper and is used in combination with sodium thiosulfate, chloramine-T, or arylantidiazotates which develop a coloration with the addition compound; they are frequently used as reagent systems for indicator vials.

When making the determination in an aqueous solution, the yellow clouding which has developed can be stabilized by adding a little solution of a heteropoly-acid (phosphorus molybdenum acid, phosphorus tungstic acid, silico-tungstic acid) probably due to molecule enlargement.

Drop test: A drop of the sample solution is placed on filter paper and is mixed with a drop of 5-percent gold chloride solution and then with a drop of 1-percent chloramine-T solution. A red-brown coloration of the spot indicates sulfur yperite.

Boundary concentration: 0.1 mg/ml.

28.2.1.5. Miscellaneous Detection Possibilities

The protection or determination method described for nitrogen yperate with 4-(p-nitrobenzyl)-pyridine and 8-oxyquinoline (see section 28.3.2.1. and 28.3.2.2.) are, when slightly modified, also suitable for the detection of sulfur yperite. Other testing methods which, however, regarding their practical use, reveal disadvantages due to low sensitivity or specificity and awkward handling, are possible with the following reagents:

(a) Potassium permanganate in a 0.003-percent solution is discolored by sulfur yperite; the boundary concentration is about 0.15 mg/ml.

(b) β-naphthol, in an alcoholic, heavily alkaline solution, will cause clouding. The boundary concentration is at 0.06 mg/ml.

(c) Potassium mercury iodide (10 g potassium iodide and 14 g mercury iodide in 70 ml of water) will produce a yellowish-white precipitate.

$$K_2[HgJ_4] + S(CH_2CH_2Cl)_2 \rightarrow S(CH_2CH_2J)_2 \cdot HgJ_2 + 2KCl$$

The boundary concentration is 0.05 mg/ml.

(d) Selenic acid (1 g SeO_2 in 100 ml of 1:1 diluted sulfuric acid) will produce an orange suspension or yellow precipitate with sulfur yperite and with arsine when heated to 85°.

(e) 2,6-dichlorphenol-indophenol. The blue redox indicator is reduced to a colorless shape at a pH of 7.0. The recording boundary in 0.01 mg.

(f) Copper (II) salts will form an additional compound. The detection limit is 0.1 mg.

(g) Nessler reagent will produce a yellowish-white precipitate.

(h) Iodate and starch in an acid solution will cause a blue stain.

28.2.1.6. Identification by Preparation of Derivatives

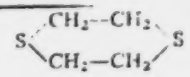
If larger quantities of sample material, for example, from ammunition discovered in various places, should be available, then reliable identification is possible by means of conversion into derivatives with a defined melting point.

(a) Sulfimine

During the reduction of sulfur yperite with an excess of aqueous solution of chloramine-T, white crystals of sulfimins will be separated after about an hour [CH_3-C_6H_4-SO_2-N = $S(CH_2CH_2Cl)_2$], whose melting point is 144.6° C.

(b) Diethylenesulfide

When we add sulfur yperite to a 20-percent solution of sodium sulfide, diethylenesulfide (dithion) is precipitated with a melting point of 111-112° C.



(28.40)

(c) Sulfoxide

When we add sulfur yperite drop by drop to the concentrated nitric acid (D.1,40), we get a bright-green liquid from which sulfoxide is precipitated as a white

precipitate in case of dilution with water. After recrystallization from 60-percent ethanol, we get colorless scales with a melting point of 110° C. Sulfoxide can also be made by dissolving sulfur yperite in glacial acetic acid and adding 30-percent hydrogen peroxide while cooling.

28.2.2. Quantitative Determination

28.2.2.1. Photometric Determination with Iodoplatinate

Chugayev found that organic sulfides react with iodoplatinate according to two possible reactions, with iodine being released in each case.

$$PtJ_6^{2\ominus} + 4R_2S \rightarrow Pt(R_2S)_4^{2\oplus} + 4J^{\ominus} + J_2 \qquad (28.41)$$

$$PtJ_6^{2\ominus} + 2R_2S \rightarrow Pt(R_2S)_2J_2 + 2J^{\ominus} + J_2 \qquad (28.42)$$

This fact can be used for the determination of bis-(2-ethyl chloride)-thioether if the iodine formed is detected or determined by means of the blue color of the adsorption compound obtained with starch. A series of determination methods with visual or photometric analysis is based on this principle. Compared to other methods, these methods offer the advantage that they are subjected to disturbance by polysulfides only to a minor degree.

Reagents (61)

Iodoplatinate (to 1 ml of a 5-percent solution of ammonium chloroplatinate, we add 3.5 ml of a freshly made 5-percent sodium iodide solution which must be free of iodine and we dilute the mixture with distilled water to 180 ml).

Starch solution (1 g soluble starch is ground up with a little water and is placed in 100 ml of boiling water; the solution must in each case be freshly prepared).

Acetic acid (50 ml of glacial acetic acid is diluted with distilled water to 1,000 ml).

Operating Procedure

The aqueous sample solution must be 5-percent acetic acid. To 10 ml of this sample solution we add 2 ml of iodoplatinate solution. After mixing, we add 2 ml of starch solution. We note the time.

After 4-5 minutes, we colorimetrize at 650-700 nm against a comparison sample which was set up with 10 ml 5-percent acetic acid. The analysis is performed according to a calibration curve which is plotted with sulfur yperite solution in 5-percent acetic acid containing concentrations between 0.005 and 0.05 mg/ml.

28.2.2.2. Measurement Analysis Determination with Bromide-Bromate Solution

Thioethers are stoichiometrically oxidized into sulfoxide in diluted aqueous solution.

$$R_2S + Br_2 + H_2O \rightarrow R_2SO + 2HBr \qquad (28.43)$$

Bis-(2-ethyl chloride)-thioether can be titered with an adjusted bromide solution whereby the terminal point is established with methyl-red. In place of the unstable bromide solution, we use bromide produced in situ electrolytically or through bromide-bromate in an acid solution. The use of the method is confined to pure sulfur yperite because polysulfides and thiodiglycol likewise react with bromine which interfere with the determination. To eliminate the error caused by the indicator's bromine consumption, it is a good idea to mix with an excess of bromide-bromine and to determine it iodometrically (63).

Operating Procedure

In a 250-ml Erlenmeyer flask with ground stopper we weigh 0.1-0.3 g of the warfare agent and we dissolve in 40 ml of glacial acetic acid. After adding 5 ml of water and 3 ml of concentrated hydrochloric acid, we slowly titer with 0.1-normal bromide-bromate solution (11.906 g KBr and 2.784 g $KBrO_3$ in 1 lit of solution) until we get a yellow color. Then we add 5 ml of a 10-percent potassium iodide solution. We allow the mixture to stand in the dark for 5 minutes and we titer the separated iodine with 0.1-normal [standard] sodium thiosulfate solution, adding a little starch solution as indicator. The computation is performed according to the following formula:

$$\% \text{ sulfur yperite} = \frac{7.952 \cdot (a-b) \cdot 100}{E};$$

a--Consumption of 0.1-normal bromide-bromate solution in milliliters
b--Consumption of 0.1-normal thiosulfate solution in milliliters
E--Weighed portion of warfare agent in milligrams

28.2.2.3. Measurement Analysis Microdetermination

In addition to the formation of sulfimine (see Section 28.2.1.6.a.) we can also get sulfoxide or sulfone in case of a reaction of bis-(2-ethylchoride)-thioether with chloramine-T in an aqueous solution.

$$CH_3-C_6H_4-SO_2NCl^{\ominus} + R_2S + H_2O \rightarrow$$
$$CH_3-C_6H_4-SO_2NH_2 + R_2SO + Cl^{\ominus} \qquad (28.44)$$

$$2CH_3-C_6H_4-SO_2NCl^{\ominus} + R_2S + 2H_2O \rightarrow$$
$$2CH_3-C_6H_4-SO_2NH_2 + R_2SO_2 + 2Cl^{\ominus} \qquad (28.45)$$

The product to be formed depends on the acidity of the solution and on the type of acid. In an acetic-acid (up to 50 percent) and sulfuric-acid solution (up to 3-normal), we consume 1 mol chloramine and 90-100 percent of the reactor product are sulfoxide. In 2-normal hydrochloric acid on the other hand we consume 2 mol and sulfone is formed. In this case, the oxidation is brought about by the chlorine which is formed in an intermediate fashion. A method for yperite determination is based on the addition of chloramine-T in acetic-acid

solution and colorametric determination of the excess with o-tolidin. A method worked out by Kinsey and Grant (62) achieves higher sensitivity. According to those authors, in the reaction of bis-(2-ethylchloride)-thioether with dichloramine-T in a water-free medium, in a complicated chlorination, 5 mol dichloramine-T are consumed per mol of yperite. The consumption of dichloramine depends on the solvent. Cyclohexane is suitable; the addition of cyclohexanol proves to be sensitizing for the catylatic chlorination of the yperite.

Operating Procedure

The warfare agent is dissolved in a mixture 80 percent cyclohexane and 20 percent purified kerosine (boiling point: 175-280° C) or poisoned water is taken out with this mixture. We then mix 1 ml of the solution in a 50 ml Erlenmeyer flask with ground stopper with 1 ml of a 20-percent solution of dichloramine-T in carbontetrachloride and we place it for 20 minutes in a water bath adjusted for 27±0.1° C after that we add 4 drops of saturated potassium iodide solution and 4 drops of glacial acetic acid and, after thorough soaking, the titer is 0.01-standard sodium thiosulfate solution until decoloration. We must not work in sunlight. This method is suitable for the determination of 5-200 µg of sulfur yperite. Computation is impossible because the dichloramine consumption is subject to certain fluctuations that depend on the purity of the solvent. One must therefore plot a standard titration curve with solutions of known yperite content and one must analyze according to it.

For the determination of smaller quantities of sulfur yperite (0.2-5 µg) we add, to 1 ml of the warfare agent solution in cyclohexane, 1 ml of a 5-percent solution of cyclohexanol in kerosine. The mixture is adjusted for 27±0.1° C in a water bath and, after the addition of 1 ml 0.1-percent solution of dichloramine-T, in carbon tetrachloride, it is kept at this temperature for exactly 20 minutes. After that, we add potassium iodide and acetic acid, as above, and the separated iodine is titered with 0.01-standard thiosulfate solution. In plotting the calibration curve, we must consider the thiosulfate used up during a blank test. We find that 1 ml of 0.01-standard thiosulfate solution corresponds to about 5 µg sulfur pyrite. In both methods, the exact maintenance of the temperature and the time is critical.

28.2.2.4. Colorimetric Determination of 1,2-bis-(2-Ethylchloride)-Ethane (Sesquiyperite) in Mixtures with Bis-(2-Ethylchloride)-Thioether (Yperite) (60)

This method is suitable for the determination of sesquiyperite in mixtures with bis-(2-ethylchloride)-thioether after both yperites have first been determined colorimetrically with 4-(p-nitrobenzyl)-pyridine. For this purpose we heat the warfare agent mixture dissolved in ethyl alcohol for 15 minutes at 70° C with 4-(p-nitrobenzyl)-pyridine and we add piperidine as base (see Section 28.3.2.2.). We get a violet-colored compound.

(28.46)

28.2.2.5. Other Methods to Determine Bis-(2-chloroethyl)-thioether

[Text] The colorimetric determination of sulphayperite is also possible with the methods indicated in the qualitative detection with phthalein and thiourea-nickel salt. The method described for the detection and determination of nitrogen yperite with 8-oxyquinoline is also applicable to sulfayperite and also the generally applicable method with 4-(p-nitrobenzyl)-pyridine. Other methods described are the following:

a) Titration with adjusted sodium hypochlorite solution using methyl red or neutral red as indicators.

b) Precipitation as double salt with copper (I)-chloride and iodometric determination of the excess copper salt.

c) Nephelometric determination of the suspension of metal selenium obtained under heating with selenic acid.

d) Reaction with the sulfhydryl groups of cysteine, urease, papain or denatured ovalbumin and determination of the remaining SH groups. The method is suitable to determine all the agents attacking the sulfhydryl groups, such as bromacetone, chlorpicrin, iodic and bromic acetic acid ester and sulfa yperite.

28.3. Halogenated Aliphatic Tertiary Amines (Nitrogen Yperites)

28.3.1. Method of Qualitative Detection

Besides the application of the method described in the qualitative detection of sulfa yperite with alkaline phthalein solution and thiourea nickel salt, a number of precipitation reagents for tertiary amines are particularly suitable for the detection of nitrogen yperite. Most alkaloids and the N,N-dialkylaminoalkylphosphates, phosphonates and thiophosphonates give similar precipitations and disturb these detections.

28.3.1.1 Precipitation with Potassium Bismuth Iodide (Reagent According to Dragendorff/ Kraut)

The orange to red precipitate has the following composition

$$[HN(CH_2CH_2Cl)_3]BiJ_4$$

Reagents:

Dragendorff reagent (produced by pouring together a solution of 8 g basic bismuth nitrate in 20 ml nitric acid (D.1.18) and a solution of 27.2 g potassium iodide in 40 ml water, after being left standing for a long time (1 to 2 days) is poured away from the potassium nitrate deposited and the solution is filled up to 100 ml).

Procedure:

5 ml of the aqueous specimen solution are treated with 0.5 ml hydrochloric acid (diluted one to one) and with 1 ml Dragendorff reagent. An orange-red deposit indicates nitrogen yperites.

Limiting Concentration:

0.01 mg/ml are still detectable.

Interferences:

Higher concentrations of sulfa yperite (more than 1 mg) give a similar reaction and naturally all the chemical agents (VX) and psychological poisons (BZ) with tertiary nitrogen atom as well as many alkaloids are detected with this reagent.

28.3.1.2. Precipitation with Phosphorotungsticacid

To avoid interferences by lewisite, dichloromethylarsine and dichloroethylarsine, adamsite and bromobenzylcyanide, the detection must be carried out in hydrochloric acid.

Reagents:

Phosophorotungsticacid, 5 percent solution in water.

Procedure:

5 ml of the aqueous specimen solution are treated with 0.5 ml hydrochloric acid and 1 ml phosphorotungsticacid. A cloudiness or gelatinous deposit indicates nitrogen yperites.

Limiting Concentration:

0.01 mg/ml may be detected.

28.3.1.3. Other Precipitation Reagents

a) With silicotungsticacid a precipitate is obtained of composition 12WO3.SiO2. /N(CH2CH2CL)3/4 which allows also the gravimetric determination of nitrogen yperites.

b) Reinecke salt (NH4/Cr(NH3)2(SCN(4/) and other complex chromium salts give with nitrogen yperites pink precipitates, which allow the detection of 0.005 mg/ml.

c) With Nessler reagents in cold conditions a yellow deposit is obtained and a brown precipitate under heat. It is possible to detect about 0.2 mg/ml.

28.3.1.4. Detection by Production of Derivatives

In the simplest case the melting points of the hydrochlorides recrystallized from acetone can be used for identification. The hydrochloride of the methyl-bis-(2-chloroethyl)-amine melts at 110 degrees C and that of the tri-(2-chloroethyl)-amine at 130 to 131 degrees C. Another possibility is the precipitation of picrates. The aqueous specimen solution is treated with saturated aqueous picrate acid solution. With larger amounts the yellow picrates depositing can be recrystallized from ethanol diluted with some water. The picrate of the bis-(2-chloroethyl) amine melt at 133 degrees C, that of the tri-(2-chloroethyl)-amine at 135 degrees C. The picrolonate of the tri-(2-chloroethyl)-amine obtained by precipitation with picrolonic acid has the same melting point.

28.3.2. Quantitative Determination

28.3.2.1. Colorimetric Determination with 8-Oxyquinoline (Oxine) [64]

The basis for this very specific method is the formation of a colored product not previously defined in the reaction between nitrogen and sulfayperites with 8-oxyquinoline in the alkaline medium.

Reagents:

8-Oxyquinoline, 5 percent solution in 95 percent ethanol.

Sodium carbonate, 10 percent solution in water.

Acetic acid, 5 percent.

Procedure:

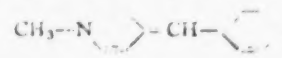
2.5 ml of the aqueous specimen solution are mixed with 2.5 ml 95 percent ethanol and slightly acidulated with the addition of a few drops of acetic acid. Thereafter 0.5 ml of the 8-oxyquinoline solution are added, agitated and after adding 0.5 ml sodium carbonate solution agitated once again for 30 seconds. After 90 minutes standing at room temperature the colorimetric study is carried out at 486 nm against a controlled experiment. The evaluation takes place with a calibration curve which is recorded with 0.01 to 1 mg agent per milliliter. In the determination of the sulfayperite heating is carriedout for 90 minutes to 45 degrees C and the measurement at 500 nm.

The qualitative detection can be carried out on the basis of the bright orange color (the blank test is yellowish-green) occurring in the presence of nitrogen yperites.

28.3.2.2. Colorimetric Determination with 4-(p-nitrobenzyl)-pyridine [66]

This method of detection and determination applicable under manifold aspects for the alkylizing compounds is based on an observation by Koenig who had obtained in the reaction of methyliodide with 4-(p-nitrobenzyl)-pyridine in the alkaline medium a

blue dye, to which the following structure was attributed:



During the Second World War in the US the general applicability of this dire reaction was established and various qualitative detections were developed for chemical agents such as sulfayperite, diphenylchloroarsine and others. Epstein /65/ continued these studies and established quantitative determinations for ethylene imines and various alkalyzing compounds, including many chemical warfare agents. By comparing the intensity of the dye it was possible to determine the activity of the different compounds or their functional groups as compared with 4-(p-nitrobenzyl) pyridine:

$$RCH_2CH_2X > RCH_2CHX_2 > RCH_2CX_3$$

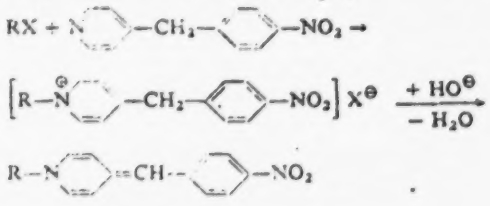
$$ArCH_2X > ArX$$

$$ROCH_2X > ROCH_2CH_2X$$

$$COCH_2X > COX$$

(X = Halogen)

In the halogens the sequence iodine bromine chlorine was established. The reaction takes place through the formation of a quarternary pyridinium salt, which in the presence of organic or inorganic bases (piperidine, triethylamine, alkaline carbonate amine, alkaline carbonates and hydroxides) is converted into the colored compound with the loss of a proton.



Besides other alkylizing compounds the following warfare agents give this color reaction:

Alkylfluorophosphonates (Sarin and Soman) /40,50/.

Sulfayperite /65/.

Secondary and tertiary nitrogen yperites /66/.

Arsenic warfare agents (lewisite, methyl, ethyl and phenyldichloroarsine and diphenylchloroarsine /65/.

Methylfluoroacetate /65/.

Chloroacetophenone /67/.

The conditions of the reaction for the optimum production of the color are different for each compound. The limiting concentrations are for some compounds for example sulfa yperite at a few micrograms per milliliter, for others like alkylfluorophosphonates, the sensitivity is lower.

Reagents:

4-(p-nitrobenzyl)-pyridine (melting point 70 to 71 degrees C, 5 percent solution in acetone).

Acetate buffer, 0.1 normal, pH 4.62.

Sodium hydroxide, 0.25 normal.

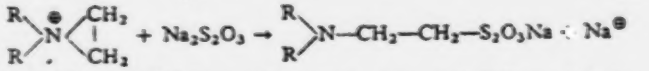
Procedure:

3 ml of the aqueous toxic solution are pipetted into a test tube with a ground stopper and the latter is placed in a boiling water bath for 20 minutes after adding 1 ml acetate buffer and 0.4 ml of 4-(p-nitrobenzyl)-pyridine solution. Then it is cooled in an ice bath and 2 ml acetone, 5 ml ethylacetate and 1.5 ml 0.25 normal sodium hydroxide are added in this sequence.

The glass is agitated about 20 times, and after pouring the content into a centrifuge glass, centrifuging is carried out for 2 minutes. The corresponding amount of the upper layer is pipetted into a dish and colorimetry is carried out at 540 nm against a reference specimen to which water was added. Because of the instability of the color formed, the operations from the addition of the sodium hydroxide until the measurements had to be carried out within 3 to 5 minutes and protected from light. The evaluation takes place according to a calibration curve which was plotted in the same way with 0.5 to 10 µg nitrogen yperite.

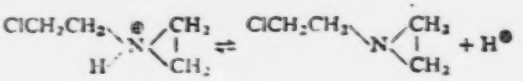
28.3.2.3. Other Methods of Determination

a) The hydrolysis of nitrogen yperites with tertiary nitrogen takes place through the fast formation of an ethyleneimonium ion. The speed of formation increases with the increase of the hydroxide ion concentration; at pH 6 the conversion is centrally completed after 5 minutes. Von Golumbic, Fruton and Bergmann established that the ethyleneimonium ion (also called aziridine ion in the Anglo-Saxon literature) can be detected by a conversion with thiosulfate.

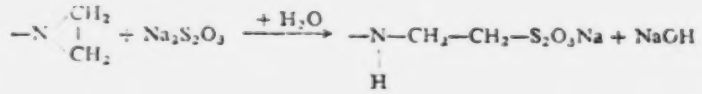


But it was found that the addition of an excess of thiosulfate and the retitration with iodine solution did not give any qualitative values. The cause may be sought in the occurrence of secondary reactions, for example the hydrolysis of the ethylene imonium ion or the dimerization. $HgCl_2 + 2HCN \rightarrow Hg(CN)_2 + 2HCl$

The hydrolysis of nitrogen yperites with secondary aminonitrogen takes place in a different way. According to the pH value an equilibrium is adjusted between the ethyleneimonium ion and ethyleneimine.



From pH 3 to 5 the speed of decomposition of the secondary nitrogen yperite increases in a manner similar to that of the tertiary compounds, later to fall to zero at about pH 8, from which the stability of the ethylene amine occurring at this pH value against a nucleophile attack is apparent. Allen and Seaman induced the reaction of ethylene amine with thiosulfate.

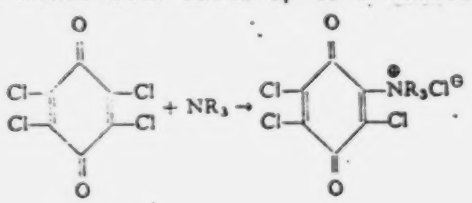


These authors established that the ethyleneimine compound can be determined quantitatively by reaction with a high excess in thiosulfate at pH 4 and determining the acid consumption of the reaction. In a solution with bicarbonate as buffer the decomposition of the secondary nitrogen yperites led to oxazolidone derivatives, so that it was impossible to establish any thiosulfate consumption.

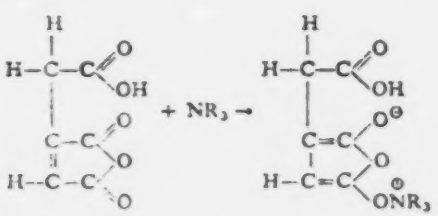
b) A possibility to determine the tris-(2-chloroethyl)-amine consists in the precipitation with potassium bismuth iodide, the dissolution of the precipitate with the addition of 8-oxyquinoline and the bromometric determination after dissolving the bismuthoxyquinolate in hydrochloric acid. Amounts up to 0.1 mg can be determined with high precision.

c) Methyl-bis-(2-chloroethyl)-amine can be determined by conversion with p-phenylphenol in alkaline solution and measurement of the fluorescence of the reaction product.

d) Two colorimetric methods of determination for tertiary amines and their salts and for quarternary amines were described by Sass and his colleagues [68]. The known detection methods for amines with chloranil in which red colors were obtained with primary amines, violet with secondary amines and emerald green with tertiary amines, was modified. By photometry of the dye at 610 nm free tertiary amines can be determined even mixed with salts up to a limited concentration of 50 µg/ml.



e) To determine the salts of tertiary amines, quarternary amines and free tertiary amines the red color occurring in the reaction of amines with cis-aconiticanhydride in acetic anhydride was used.



The limiting concentration of the determination is at 3 µg/ml; the color is photometrized at 500 nm. By applying both methods it is possible to determine free tertiary amines besides their salts or the quarternary form.

f) Through the determination of nitrogen yperites with alkaline thymolphthalein reagent as well as with thiourea and formation of thioronium salts data are obtained in the description of the similar method for sulfayperites (compare section 28.2.1.1. and 28.2.1.2.).

28.4. Chemical Warfare Agents and Poisons Containing Arsenic

28.4.1. Qualitative Methods of Detection

To analyze the warfare agents containing arsenic it should be noted that besides the specific analytical determination of the individual agents the toxic decomposition products retaining to a great extent their arsenic content must be noted. This applies in particular in the examination of drinking water and foodstuffs.

28.4.1.1. General Methods of Detection

Reduction to Hydrogen Arsenide.

Hydrogen in the "status nascendi" reduces primary and secondary aliphatic arsines such as dimethyl and ethyldichloroarsine, 2-chlorovinyldichloroarsine (α-Lewisite) and bis-(2-chlorovinyl)-chloroarsine (β-lewisite), to hydrogen arsinide. For tris-(2-chlorovinyl)-arsine (γ-lewisite) and the aromatic arsines such as phenyldichloroarsine, diphenylchloroarsine (Clark I), diphenylcyanoarsine (Clark II) and diphenylaminechloroarsine (adamsite) this direct reduction is impossible. These compounds must previously be mineralized by means of a method indicated in the quantitative determination of chemical warfare agents containing arsenic (compare section 28.4.2.1). The arsenic trioxide obtained is then reduced. The detection of the hydrogenarsenide produced can be carried out with:

a) Silver nitrate [69].
A lemon yellow spot of AsAg3.AgNO3 is formed on a paper impregnated with concentrated silver nitrate solution. When treated with water the spot is colored black by separation of metal silver.

b) Mercury (II)-bromide [70].
Reagent paper impregnated with this substance gives a yellow to brown color which deepens to red-brown by treatment with potassiumiodide solution

$$3HgBr_2 + AsH_3 \rightarrow As(HgBr)_3 + 3HBr$$

$$As(HgBr)_3 + AsH_3 \rightarrow As_2Hg_3 + 3HBr$$

c) Goldchloride [71].
On a paper soaked with 1 percent gold chloride solution by reduction to metal gold a blue to bluish-red spot is formed. This detection has the maximum sensitivity.

$$2AuCl_3 + AsH_3 + 3H_2O \rightarrow 2Au + 6HCl + H_3AsO_3$$

For detection with silver nitrate the following procedure applies:

Reagents:

Reagent paper (impregnated immediately before use) with a 20 percent solution of silver nitrate).
Metal zinc, granulated and free from arsenic.
Sulfuric acid, 20 percent.

Procedure:

A few milliliters of the specimen solution or attack solution acidulated with sulfuric acid are poured into a small test tube and a small crystal of copper sulfate and two zinc granules are added. After fixing in the upper part of the tube a plug of lead acetate cotton, the reagent paper is placed on the openings. A yellow spot formed after some time on the paper and which becomes black immediately when treated with water indicates warfare agents containing arsenic.

Detection with Hydrogen Sulfide

Through the formation of the corresponding arsenic sulfides the precipitates are separated. 2 to 3 ml of the aqueous specimen solution are treated until precipitation with a freshly prepared solution of hydrogen sulfide acidulated with hydrochloric acid. In the presence of aromatic arsines the procedure is carried out with alcoholic specimen solution and saturated alcoholic solution of hydrogen sulfide.

If necessary ice water must be used for cooling in the separation of sulfides. It is advantageous to apply the so-called solid hydrogen sulfide; these are compounds such as thioacetamide or ammonium thiocarbanate which separates hydrogen sulfide in acid solution. The following arsenic sulfides are precipitated individually:

a) Lewisite gives a white deposit of ClCH=CH-As=S. The limiting concentration is 0.02 to 0.05 mg/ml.

b) Dimethylchloroarsine gives a yellowish deposit of CH3-As=S with a melting point of 110 degrees C.

c) Diethylchloroarsine gives an emulsion of yellowish oil. The limiting concentration is 0.02 to 0.05 mg/ml.

d) Diphenylchloroarsine gives a white deposit of C6H5-As=S with a melting point of 152 degrees C.

e) Diphenylchloro- and cyanoarsine gives a white deposits of (C6H5)2As2S with a melting point of 67 degrees C.

Detection with Mercury (I)-Nitrate

If a few drops of a weak nitric acid 5 percent aqueous solution of mercury (I)-nitrate are added to the aqueous specimen solution, deposits are obtained for:

a) ∝-lewisite (white deposit of calomil, Hg2Cl2 which becomes gray within 12 hours; the limiting concentration is 1 mg/ml).

b) Dimethylchloroarsine (gray deposit of metal mercury; with limiting concentration of 1 mg/ml).

c) Diethylchloroarsine (white deposit which quickly becomes gray; the limiting concentration is 2 mg/ml).

d) Diphenylchloroarsine (white deposit).

Diphenylchloro- and cyanoarsine form a white deposit only after some time.

Detection with Hypophosphorus Acid

Except for adamsite or warfare agents containing arsenic give with hypophosphorus acid characteristic deposits. According to Bougault the reagent solution is prepared as follows:

10 g sodium hyposulfite is dissolved under heating in 10 ml water and concentrated hydrochloric acid is added up to 100 ml. After decanting of the deposited sodium chloride we add per 10 ml solution 1 to 2 drops 0.1 normal iodine-potassium iodide solution.

Procedure:

1 to 2 ml of the aqueous specimen solution are treated with 5 ml reagent. The formation of a deposit is observed and heating applied if the latter does not occur for about 15 to 30 minutes in the water bath. In the presence of chemical agents containing arsenic we obtain with lewisite a white, and later yellow deposit, for methyl- and ethylarsinic-dichloride a white to yellowish-brown deposit and for diphenylchloroarsine a white to yellowish-green deposit and for diphenylchloro- and cyanoarsine after heating a white turbidity.

Sulfur yperite in high concentration gives an emulsion; under heating the solution becomes clear by the agglomeration of the drops.

Other General Methods of Detection

a) Primary aliphatic arsine, such as -lewisite, dimethyl- and diethylchloroarsine reduced osmiumtetroxide to the black osmiumdioxide.

$$OsO_4 + 2RAsCl_2 + 4H_2O \rightarrow OsO_2 + 2RAsO(OH)_2 + 4HCl$$

Silica gel impregnated with 1 percent osmiumtetroxide solution can be used for indicator tubes.

b) The reaction of primary aliphatic arsines with tin (II)-chloride in concentrated acid is also suitable for indicator tubes, in accordance with the Bettendorf detection. A yellow ring is formed on suitably impregnated silica gel when the air containing lewisite is sucked through.

c) A silica gel impregnated with molybdic acid and zinc sulfate is colored blue when air containing alkyldichloroarsines are sucked through because of the reduction of molybdic acid. This reaction is very sensitive.

d) The products obtained in the oxidation of diphenylarsines with iodine solution give with acetic acid urinylnitrate solution deposits, with green color for adamsite.

e) The chemical agents containing arsenic can be detected with high sensitivity except adamsite, with the iodine copper reagent according to Grignard.

Detection through the Production of Derivatives

The hydrolysis and oxidation products and the above-mentioned sulfides are suitable for identification purposes. A survey is given below of the melting points of these compounds:

Hydrolysis of	gives	melting point
methyldichloroarsine	CH3AsO	95 degrees C
∝-lewisite	ClCH=CHAsO	143 degrees C
β-lewisite	/(ClCH-CH)2As/2O	62 to 63 degrees C
diphenylchloro- and cyanoarsine	/(C6H5)2As2/)	92.5 to 93.5 degrees C
adamsite	/HN(C6H4)2As/2O	350 degrees C

Oxidation of	gives	melting point
dimethylchloroarsine	CH3AsO(OH)2	159 degrees C
diethylchloroarsine	C2H5AsO(OH)2	99 to 100 degrees C
∝-lewisite	ClCH=CHAsO(OH)2	130 degrees C
β-lewisite	(ClCH=CH)2AsO(OH)	120 to 122 degrees C
diphenylchloro and cyanoarsine	(C6H5)2AsO(OH)	175 degrees C

28.4.1.2. Special Methods of Detection

Detection of Lewisite

a) The detection of the acetylene formed in the decomposition of ∝-lewisite with strong alkali lye with the Ilosvay reagent [72] as copper acetylide is very sensitive and specific for lewisite.

$$ClCH{=}CHAsCl_2 + 6NaOH \rightarrow 2CH{\equiv}CH + Na_3AsO_3 + 3H_2O + 3NaCl$$

$$CH{\equiv}CH + 2Cu^{\oplus} \rightarrow CuC{\equiv}CCu + 2H^{\oplus}$$

Procedure:

2 ml of the aqueous or 1 ml of the alcoholic specimen solution, mixed with 1 ml water are treated with 0.5 ml 30 percent alkali lye. After sealing the test tube mixing is accomplished by slight tilting. After 5 minutes the solution is acidulated slightly with dilute acetic acid, while the neutralization heat is removed quickly by cooling with water. After adding 1 ml reagent a red color appearing immediately or after a short time with high concentrations a red deposit indicates the presence of ∝-lewisite in the specimen.

Limits of detection:

0.005 mg lewisite per milliliter can be detected.

Interferences:

The detection is specific.

An addition of 2 percent gelatin solution keeps the copper acetylide in colloidal form in the solution so that by comparison with standard solutions a quantitative evaluation can be carried out. A modified reagent [73] contains 0.2 g copper carbonate, 12 g arsenictrioxide, 12 g sodiumhydroxide and 1 ml piperidine in 100 ml water and gives a bright red color for detection. Moreover the precipitation with silver nitrate is possible as silver acetylide.

b) Silica gel which is impregnated with a solution of ergosterin[1] in chloroform gives when agitated with lewisite vapors a violet color and with higher concentrations it becomes deep green. Sulfur yperite produces with longer effect of higher concentration only a week coloring; hydrochloric acid vapors give with the reagent a deep rust brown color.

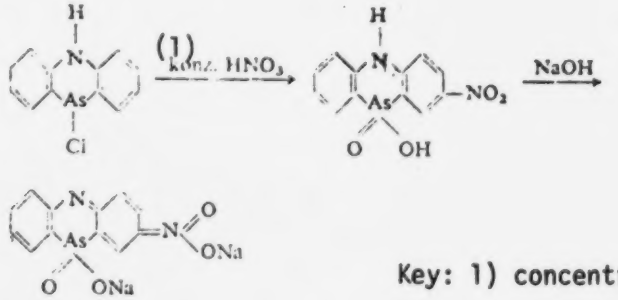
Detection of Diphenylcyanoarsine

The presence of diphenylcyanoarsine in a specimen can be detected by heating with alcoholic potassium lye and the detection of the cyano group identified by one of the usual methods.

Detection of Adamsite (Diphenylaminochloroarsine)

a) A simple possibility of detection is offered by the intense red coloring which is found when pouring over a few crystals of the specimen substance (or the residue after the evaporation of an extract) of concentrated sulfuric acid. The nature of the colored product is not known. With bromobenzylcyanide a brownish-red color is obtained and with bromobenzyl heated a red color.

b) The detection in the form of intensely red sodium salt of the nitration product is highly sensitive and specific for adamsite.



Key: 1) concentrated

[1] C26H440 provitamin; in the irradiation with ultraviolet light it is converted to vitamin D2.

Reagents:

Concentrated nitric acid.

Soda lye, 30 percent.

Procedure:

A drop of nitric acid is added to a few crystals of the chemical agent or the residue which was obtained after evaporation of 5 to 10 ml of a solvent extract and evaporation carried out on the water until dry. After cooling a drop of soda lye is added to the residue. A cherry red color indicates the presence of adamsite.

Detection Limits:

About 0.5 to 1 µg adamsite are detectable.

c) The detection which is based on the formation of diphenylamine under heating with hydriodic acid is more complicated to accomplish.

$$HN(C_6H_4)_2AsCl + 2HJ \rightarrow (C_6H_5)_2NH + AsClJ_2$$

The diphenylamine is distilled with water vapor and according to the principle of the known nitrate detection can be identified after adding nitrate and concentrated sulfuric acid by a blue color. The blue coloring which is obtained with the addition of concentrated sulfuric acid to which some nitric acid was added to adamsite is also based on the diphenylamine reaction.

d) A reagent which consists of equal volumes of 10 percent silver nitrate solution and glacial acetic acid, indicates specifically the presence of adamsite. By heating on the water bath the stable greenish-yellow color is formed which is visible even with 0.02 mg adamsite.

Differentiation of the Chemical Agents Containing Arsenic

Methyl-, ethyl- and phenyldichloroarsine as well as diphenylchlorarsine for which no special detection processes are known are differentiated through the characteristic course of general detection processes with hydrogen sulfide, mercury (I) nitrate and the Bougault reagent (compare Table 28.2) after which arsenic was established by means of the reduction detection process (compare section 28.4.1.1.).

28.4.2. Quantitative Determination

28.4.2.1. Reduction to Hydrogenarsenide

The general principle of this method has already been discussed in section 28.4.1.1. in the description of the qualitative detection. Before reduction in many cases the mineralization of the specimen substance is needed. This applies in the presence of aromatic arsines which cannot be reduced directly and in the determination of chemical agents containing arsenic in foodstuff specimens, especially in fats. The mineralization is possible by a series of methods, of which the following one was selected as suitable for the examination of foodstuffs [11].

About 100 g of the material to be studied are crushed and mixed thoroughly. 2 to 3 g are placed in a Kjeldahl container and treated with 5 ml 30 percent halogen peroxide (perhydrol). After about 10 minutes 10 ml concentrated sulfuric acid are added in drops and the vessel is carefully heated with a small flame. When the content of the vessel begins to get brown, heating is stopped, cooling is carried out and after adding a few milliliters of hydrogen peroxide the heating is continued until the appearance of sulfuric acid vapors. This is repeated until the liquid no longer becomes brown with boiling up to 15 minutes. In case of fats the attack solution may react for several hours. Thereafter 0.5 g hydrizine sulfate is added without allowing any to remain suspended in the neck of the vessel. After repeated half an hour heating then the contents of the vessel cooled again in which arsenic occurs in the trivalent form is used for the determination. In a similar way a smaller amount of the isolated warfare agent or the alcoholic extract from foodstuffs and fats can be treated. The omission of the reduction of the arsenic occurring after the digesion in the pentavalent form to the trivalent form by means of hydrizine sulfate causes the reduction to hydrogen arsenide to slow down and increases the time for the evaluation of the determination to more than double.

Reagents:

Mercury (II)-bromide paper (filter paper is soaked for about 1 hour with 5 percent alcoholic solution of $HgBr_2$ and dried in the air, the paper is kept protected from light in the exsiccator on phosphorus pentoxide).

Granulated zinc free from arsenic (it is placed before use for 1 to 2 minutes in a 0.05 percent copper sulfate solution and rinsed with water).

Sulfuric acid 20 percent free from arsenic.

Lead acetate cotton (surgical cotton is soaked with 5 percent solution of lead acetate and dried).

Procedure:

10 ml of the attack solution previously filled up to a desired volume are poured in the vessel of a Gutzeit apparatus (see Figure 28.1). After adding 20 ml sulfuric acid water is filled up to 50 ml. After the lower tube of the attachment was coated with a loose plug of lead acetate cotton and the upper tube with a band of mercury bromide paper, 5 g zinc are added to the vessel, the cover is set up quickly and kept for 1 hour in the darkness. The evaluation takes place generally with comparison with a series of papers which were colored brown by reduction of arsenic trioxide solutions of definite concentrations. Such papers can be used for some time as reference scale when kept in the darkness. The length of the colored area is a measure of the amount of arsenic when papers of certain dimensions are used. For 2 mm width the following values apply [70]:

2	5	9	11	13	14,5	16	18	20	22	mm
0,02	0,05	0,1	0,15	0,2	0,25	0,30	0,35	0,40	0,50	mg As(1)

Key: 1) arsenic

In other variants of the attachment for the Gutzeit apparatus the reagent paper is stretched in a calibrated opening. The round spot is compared with the self-produced reference papers or with a printed color scale. The accomplishment of a control test is advisable for checking the reagents (zinc, sulfuric acid) for freedom from arsenic in every case. With this method up to about 1 µg arsenic can be determined.

Figure 28.1: Instruments for determining arsenic according to Gutzeit.

A very sensitive and easily reproduced method is the colorimetric determination of the hydrogen arsenide produced with silver diethyldithiocarbamate [11].

Reagent:

0.5 percent solution of silver diethyldithiocarbamate in freshly distilled pyridine. The reagent solution when kept in the darkness and cooled can be preserved for several months.

The production of the silver salt is carried out by the following method: 2/25 g diethyldithiocarbamicacid or the calculated amount of sodium salt are dissolved in 100 ml water. By adding in parts a silver nitrate solution (1.7 g AgNO3 in 100 ml water) the lemon yellow silver salt is precipitated, filtered away and after thorough washing in water dried in the vacuum exsiccator. Thereafter the salt is kept in the darkness.

Procedure:

The production of hydrogen arsenide takes place in the usual manner. The vessel for the production is connected through the transfer tube through an absorption vessel containing a measured volume (5 ml) of the reagent solution. After 30 minutes the extinction of the red color formed is measured at 540 nm. The evaluation takes place on the basis of a calibration curve plotted with arsenictrioxide. The detection limit of the method is at 0.05 µg arsenic.

The method is disturbed by antimonyhydride which also gives a red color with the reagent. Hydrogensulfide gives a black color. By inserting a plug of lead acetate cotton in the transfer tube or the neck of the production vessel this disturbance can be prevented by the decomposition of the hydrogen sulfide as lead sulfide.

Table 28.2 : Differentiation of Chemical Warfare Agents Containing Arsenic

No.	Warfare Agent	Hypophosphoric Acid	Hydrogen Sulfide	Mercury (I) Nitrate	Ilosvay Reagent	Concentrated Sulfuric Acid
1	lewisite	white, later yellow-brown deposit	white deposit	white deposit, slowly becoming gray	red	
2	methyl dichloroarsine	white to yellow-brown deposit	yellowish deposit	gray deposit		
3	ethyl dichloroarsine	white to yellow-brown deposit	yellowish oil	white deposit, quickly becoming gray		
4	phenyl dichloroarsine	white to yellow-brown deposit	white deposit	white deposit		
5	diphenylchloroarsine	after heating white turbidity	(white turbidity)	(white deposit)		
6	diphenylcyanoarsine	after heating white turbidity	(white turbidity)	(white deposit)		
7	adamsite					red

The reactions in parentheses are only visible after some time.

28.4.2.2. General Iodometric Determination of Chemical Agents Containing Arsenic

In this method applicable in the determination of all the poisons containing arsenic the substance is mineralized and the arsenic acid formed is titrated iodometrically.

012 to 0.3 g of the poison are weighed in a Kjeldahl vessel and after adding 10 ml concentrated sulfuric acid and 1 ml fuming nitric acid it is heated for 1 hour until boiled. After cooling 50 ml water are added, evaporation is carried out and the treatment repeated as described above. After cooling once again 10 ml water, 2 g potassium iodide and if there is a deposit more water is added successively until the dissolution. After standing for 30 minutes in the dark the iodine separated is titrated with 0.1 normal sodium thiosulfate solution.

1 ml 0.1 normal sodium thionate solution corresponds to

8.043 mg methyldichloroarsine
8.744 mg ethyldichloroarsine
11.15 mg phenyldichloroarsine

13.228 mg diphenylchloroarsine
12.756 mg diphenylcyanoarsine
13.878 mg diphenylaminochloroarsine.

28.4.2.3. Iodometric Determination of Methyl-, Ethyl- and Phenyldichloroarsine

The determination is based on the oxidation of the product of hydrolysis of the poisons with iodine into arsonic acid

$$RAsCl_2 + 4NaOH \rightarrow RAs(ONa)_2 + 2NaCl + 2H_2O$$

$$RAsO + J_2 + 2H_2O \rightarrow RAsO(OH)_2 + 2HJ$$

Procedure:

1 g of the poison is weighed in a 100 ml standard vessel and agitated with 20 ml water and 15 ml 10 percent soda lye until complete dissolution. After filling to 100 ml each time 25 ml is pipetted into Erlenmeyer flasks, treated with 30 ml water and 1 to 2 drops of phenolphthalein indicator and neutralized with dilute sulfuric acid until the pink color disappears.

After cooling 50 ml saturated sodium bicarbonate solutions and 1 ml star solution are added. Thereafter the titration is carried out with 0.1 normal iodine solution until the color becomes blue.

1 ml 0.1 normal iodine solution corresponds to:

8.043 mg methyldichloroarsine
8.744 mg ethyldichloroarsine
11.15 mg phenyldichloroarsine.

28.4.2.4. Iodometric Determination of Diphenylchloroarsines

The principle of the determination is also the hydrolysis and the oxidation with iodine into diphenylarsonic acid.

$$(C_6H_5)_2AsCl + J_2 + 2H_2O \rightarrow (C_6H_5)_2AsO(OH) + 2HJ + HCl$$

Procedure:

0.2 to 0.4 g of the chemical agent are weighed in an Erlenmeyer flask and dissolved in 10 to 15 ml benzol or chloroform. After adding 20 ml saturated aqueous sodium bicarbonate solution the titration is carried out with 0.1 normal iodine solution with violent agitation until the color of the solvent turns violet. 1 ml of the 0.1 normal iodine solution corresponds to 13.228 g diphenylchloroarsine.

28.4.2.5. Colorometric Determination of Diphenylaminochloroarsine (Adamsite) [74]

The basis of this method is the color reaction described in section 28.4.1.2.

Reagents:

Mixture of 10 percent concentration nitric acid and 90 percent glacial acetic acid.

Procedure:

0.2 to 1 ml of the solution of chemical agent are treated with 0.5 ml reagent and 10 ml 20 percent soda lye. After filling with water up to 20 ml the violet color is subject to colorimetry at 530 nm. The evaluation is carried out according to a calibration curve which was plotted with 1 to 8 µg adamsite.

1 to 5 µg adamsite can be determined by colorimetric evaluation of the orange-yellow suspension formed with the addition of sulfuric acid to the acetone solution with the addition of an emulsifier (polyalkylglycolether).

28.5. Hydrocyanic Acid and Cyanichalides

In view of their importance as poisons and their manifold application in chemical industry and electroplating techniques, a large number of methods have been established todetect and determine prussic acid, its salts and compounds. Many of the methods described for hydrocyanic acid and cyanides are applicable for the analytical detection of cyanic halides.

28.5.1. Methods of Qualitative Detection for Hydrocyanic Acid and Cyanides

28.5.1.1. Berlin Blue Reaction

The formation of Berlin Blue is a specific detection for cyanide anions.

$$Fe^{3\oplus} + 2CN^{\ominus} \rightarrow Fe(CN)_2$$

$$Fe(CN)_2 + 4CN^{\ominus} \rightarrow [Fe(CN)_6]^{4\ominus}$$

$$Fe(CN)_6^{4\ominus} + 4Fe^{3\oplus} \rightarrow Fe_4[Fe(CN)_6]$$

Procedure:

Some milliliters of the specimen solution are treated until the weakly alkaline reaction with soda lye. 2 to 3 drops of 1 percent iron(II)-sulfate solution are added, heated and treated with 2 to 3 drops of 10 percent iron(III)-chloride solution. The greenish-blue to blue color formed after acidulation with dilute hydrochloric acid or a blue deposit shows the presence of cyanide. The limiting concentration is 0.02 mg/ml.

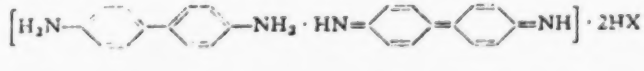
28.5.1.2. Detection of Copper Acetate/Benzidine Acetate [837]

This detection applied very often is based on the increase of the oxidation potential of copper(II) salts as compared with benzidine by the formation of insoluble copper(I) cyanide.

$$Cu(Ac)_2 + 2HCN \rightarrow Cu(CN)_2 + 2HAc$$

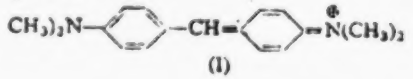
$$2Cu(CN)_2 + H_2O \rightarrow Cu_2(CN)_2 + 2HCN + {}^1/_2O_2$$

Benzidine is oxidized into a merichinoid blue compound.

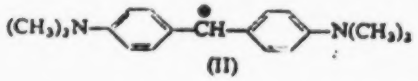


The detection system is used predominantly as paper test (compare seciont 32.2.3.) or in test tubes. The advantage of the use of o-tolidine is that reagent solution and the

color produced are more stable; on the other hand it is oxidized more easily. The same advantages are obtained by substituting benzidine by tetramethyldiaminodiphenylmethane (methane base or tetra base). A blue chinoid compound is formed or a carbonium cation (I or II). Since benzidine has a highly cancerogenic effect, the methane base should be preferred.



(I)



(II)

The drawback of this detection process is the disturbance by a large number of oxidation agents.

28.5.1.3. Detection with Sodiumpicrate

Sodium picrate gives with hydrocyanic acid a sodium salt of isopurpuric acid. The detection is carried out in the presence of alkaly as paper test of in solution. A reddish-brown to orange-red color of the yellow solution is obtained. The limiting concentration is at 0.3 mg/ml. Reducing substances disturbs the detection.

28.5.1.4. Detection by Formation of Nondissociated Heavy Metal Cyanides

In the reaction of hydrocyanic acid with mercury(II)-chloride an equivalent amount of hydrochloric acid and nondissociated mercury cyanide are formed.

The hydrochloric acid is detected by indicators such as Congo Red, bromothymol blue or methyl orange. This detection process in which silver nitrate as well as copper and palladium salts can be used is suitable for testing papers and tubes.

28.5.1.5. Demasking of Metal Chelates

1. Palladiumdimethylglyoxime

   In this detection process dimethylglyoxime (D) is demasked from an alkaline solution of the sodium-palladiumdimethylglyoxime (PdD2) through the effect of cyanide. With the addition of nickel chloride solution containing ammonium salts, a red nickel dimethylglyoxime precipitates.

$$[PdD_2]^{2\oplus} + 4CN^{\ominus} \rightarrow [Pd(CN)_4]^{2\ominus} + 2D^{2\ominus}$$

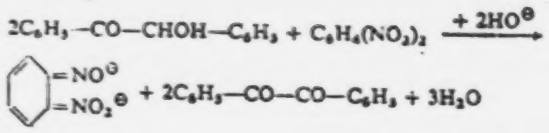
   The limiting concentration is at 1 Ag cyanide/ml.

2. Copper(II)-oxinate

   The 8-oxyquinoline demasked in the reaction of cyanide ions with copper(II)-oxinate forms with the added aluminum salt the fluorescent aluminum oxinate. It is possible to detect 2.5 Ag cyanide.

28.5.1.6. Detection by the Catalytical Acceleration of the Benzoine Condensation [84]

The known benzoine condensation is catalyzed by traces of cyanide. By using a sensitive color reaction on the benzoine formed with o-dinitrobenzol this fact can be used to detect microquantities of cyanide.



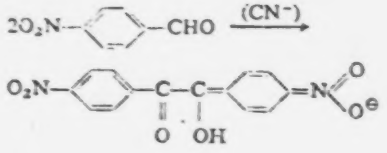
Reagents:

Benzaldehyde (0.5 ml are treated with 0.5 ml 25 percent soda lye and 4 ml ethanol, the reagent must be colorless and is to be freshly produced each time).

o-dinitrobenzol, 5 percent in benzol.

Procedure:

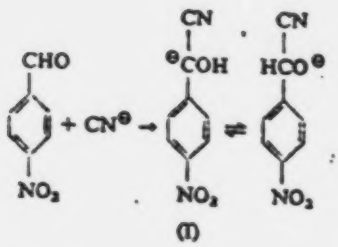
In a microtest tube 1 drop of the specimen solution is treated with 1 to 2 drops of benzaldehyde solution and heated for 2 to 5 minutes on the water bath. A drop of dinitrobenzol solution is added with further heating. According to the concentration of cyanide after 1 to 3 minutes a more or less intense violet color is produced. It must be compared each time with the controlled test. The detection limit is 0.01 λg. In the presence of sulfides and compounds which act in alkaline solutions as hydrogen donors, the detection cannot be used. Similarly through the catalytical effect of cyanide ions from p-nitrobenzalhyde in the presence of alkali a colored azyloine condensation product is formed [85].



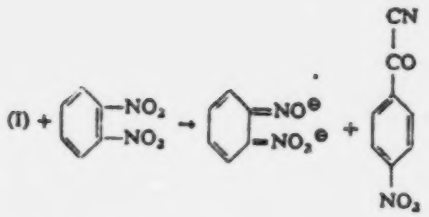
A further increased sensitivity was achieved by Guilbault and Kramer [86] by the simultaneous use of p-nitrobenzaldehyde and o-dinitrobenzol. The cyanohydrin reduces o-dinitrobenzol to the blue dianion of the o-nitrophenylhydroxylamine. Since the cyanide ion is formed again in this reaction and can react once again, the detection achieves a very high sensitivity.

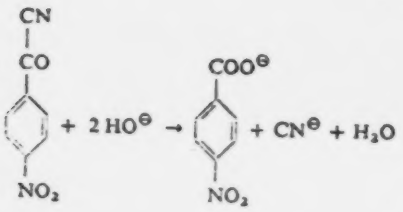
Reagents:

A. p-nitrobenzaldehyde, 0.2 molar in glycolmonomethylether
B. o-dinitrobenzol, 0.2 molar in glycolmonomethylether.
C. soda lye, 0.5 molar.



(I)



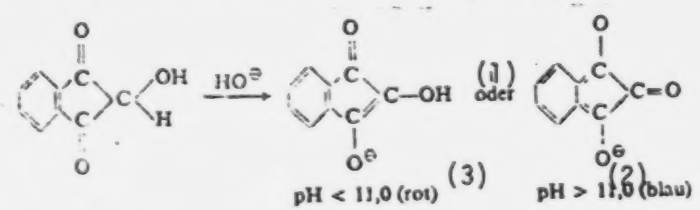


Procedure:

1 ml specimen solution is treated with 0.5 ml A and B and 0.2 ml C. A purple color indicates the presence of cyanide. The detection limit is at 0.01 µg cyanide.

By measuring the extinction at 560 nm the method can be used for the quantitative determination of cyanide and chemical agents which produce cyanide in the hydrolysis.

Similarly ninhydrine reacts with cyanide ions. The cyanohydrin formed in the intermediate stage gives according to a not totally clarified reaction course 2-oxy-1,3-diketohydrinden while the cyanide ions are formed once again. The 2-oxy-1,3-diketohydrinden forms according to the pH value two anions of different color.



Key: 1) or; 2) blue; 3) red

Reagents:

A. Potassium sodium carbonate, 5 percent in water
B. Ninhydrine, 5 percent in ethanol.

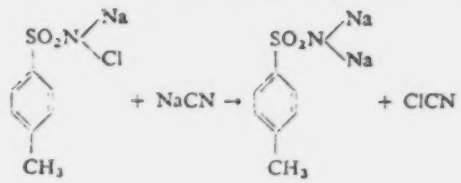
Procedure:

1 ml of the specimen solution is treated with 1 drop each of A and B and mixed by swiveling. According to the cyanide concentration a red color appears immediately or after short standing. The limiting concentration is 0.1 µg/ml.

When a drop is added of 0.5 percent solution of o-dinitrobenzol in ethanol to the reaction mixture just as in the previously described detection systems a stable violet color is obtained and 0.05 µg cyanide/ml can be detected.

28.5.1.7. Detection by Formation of Cyanohalide

But one of the most important possibilities of detection for prussic acid is the conversion by chloramines or bromine water into cyanogen chloride or bromide and the application of the detection system described in section 28.5.2.1. for cyanogen halides. When using bromine water after 1 to 2 minutes the excess is destroyed by adding arsenic acid or phenol solution.

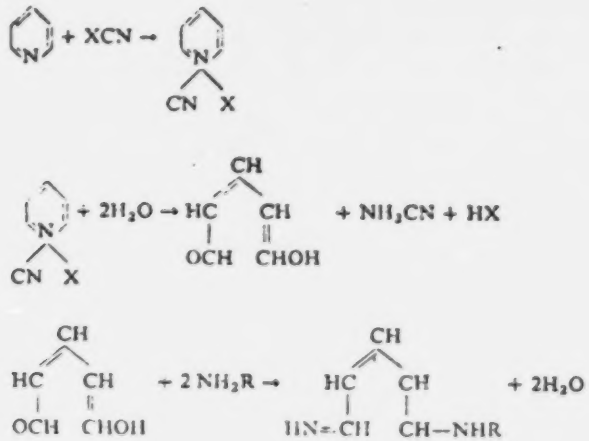


28.5.2. Qualitative Methods of Detection for Cyanogen Halides

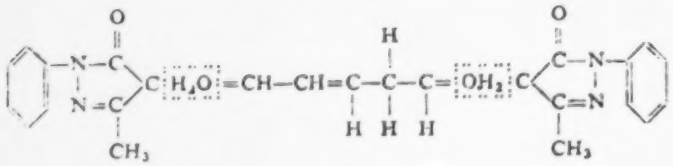
Part of the methods described for hydrocyanic acid are also suitable to detect cyanogen halides.

28.5.2.1. Reaction with Pyridine

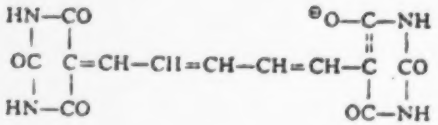
The most important methods of detection and determination for cyanogen halides and after conversion for hydrocyanic acid are based on the reaction according to Zincke/Konig [87]. Cyanogen halides react with pyridine and similar compounds with tertiary nitrogen with formation of glutaconaldehyde, which is condensed with various primary aromatic amines into polymethine dyes (Shiff Basin). For the progress of this reaction the opening of the pyridine ring is important. It takes place after adding the cyanogen halide and the change of valency of the cyclic nitrogen atom from 3 to 5 under the hydrolyzing effect of the water.



According to this principle many methods have been established, while besides different variants in the experimental conditions instead of pyridine picoline, anabasin and 4-benzylpyridine were used and as amines aniline, benzidine, o-tolidine, toluidine, p-phenylenediamine, resorcinol, dimethyldihydroresorcinol (dimedon) and barbituricacid were used. A special reagent is used by Epstein [36]. He obtained by condensation of glutakonaldehyde with 3-methyl-1-phenyl-5-pyrazolone a blue product.



The method has been modified in different ways and been rendered more sensitive allowing the determination of 0.2 µg/ml. The 3-methyl-1-phenyl-5-pyrazolone can be replaced by ethylacetonedicarbonate or ethylacetoacetate [88]. Among the many amines indicated benzidine, dimedon and barbituricacid [89] are used predominantly combined with pyridine. The use of the last reagent offers as compared with benzidine the advantage of higher sensitivity and higher stability of the color form. The sensitivity to disturbances by oxidizing substances and not for the least the cancerogenic effect of benzodine are further reasons for replacing it by barbituricacid or other suitable compounds. A reddish-violet condensation product is formed of glutacondialdehyde with 2 ml barbituricacid:



The practical accomplishment of the qualitative detection can be carried out according to the procedure described in section 28.5.3.2. for the photometric determination.

28.5.2.2. Differentiation of the Cyanogenhalides

A possibility for differentiating the cyanogenhalides is achieved by their behavior with regard to reducing agents. In acid solution cyanogenchloride is not reduced by iodide and thiosulfate. Cyanogenbromide on the other hand is reduced very quickly by thiosulfate, slowly with iodide and sulfide. Cyanogeniodide is reduced instantly by all reducing agents into cyanide.

28.5.3. Quantitative Determination of Hydrocyanicacid and Cyanide

28.5.3.1. Titration with Silver Nitrate

Cyanide can be titraded by argentometry in neutral solution according to the method of Mohr, in acid solution according to the method of Volhard or in alkaline solution according to the method of Liebig. For the last method the initial excess of cyanide causes the dissolution of silver cyanide as a complex alkali silver cyanide. The first silver excess gives a turbidity, through which the final point of titration is recognized.

The classical method is improved by the use of the Feigl silver reagent dimethylaminobenzylidenerhodanine /91/ as indicator for silver excess.

The indicators used for the argentometric determination of cyanide also includes diphenylcarbazide, dithizone, thiofluorescein and variamine blue.

$$AgCN + KCN \rightarrow K[Ag(CN)_2]$$

$$K[Ag(CN)_2] + AgNO_3 \rightarrow 2AgCN + KNO_3$$

Procedure /92/:

The phenolphthaleinalkaline cyanide solution (30 to 50 ml) is treated with 0.5 ml indicator (30 mg dimethylaminobenzylidenerhodanine in 100 ml acetone). Then the titration is carried out from a microburette with 0.01 normal silver nitrate solution until the originally yellow color assumes a reddish tinge. 1 ml of the silver nitrate solution corresponds to 0.52 mg cyanide ion. The minimum quantity which can be determined is 0.02 mg cyanide in the sediment.

28.5.3.2. · Colorimetric Determination after Conversion into Cyanogenchloride /89/

The method indicated below is one of the variants of the reagent system described in section 28.5.2.1.

Reagents:

Chloramine, 1 percent aqueous solution of monochloramine-T(B).

Pyridine-barbituricacid reagent.

In a 50 ml measurement flask 3 g barbituricacid are weighed and made into a paste with about 30 ml water, after adding 15 ml pyridine we agitate until the barbituric acid is dissolved, finally 3 ml concentrated hydrochloricacid are added and water is filled up to the mark, the reagents must be colorless.

Procedure:

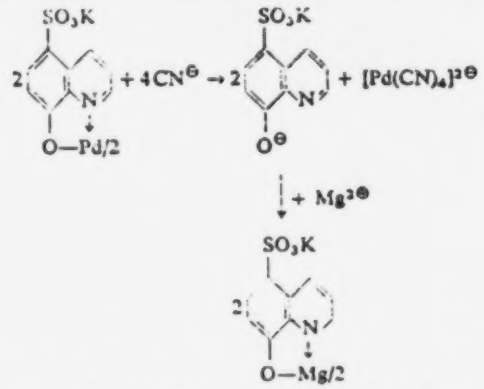
20 ml of the aqueous specimen solution (from pH 2 to 10) are treated with 1 ml chloramine solution, agitated and after 1 to 2 minutes 3 ml reagent solution are added. The reddish-violet color is photometrized after 8 minutes at 570 nm. The evaluation is carried out on the basis of the calibration curve.

With the qualitative detection in which even smaller specimen volumes can be processed in the test tube, up to 0.01 μg cyanide per milliliter can be identified. Thiocyanates and oximes represent disturbing factors in this process.

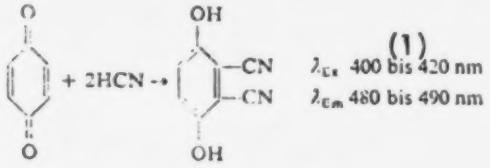
28.5.3.3. Fluorimetric Methods of Detection and Determination

The tiniest amounts (up to 0.05 μg) of hydrocyanic acid may be determined after conversion with chloramine-T into cyanogenchloride by reaction of the latter with nikotinamide in alkaline solution into a strongly fluorescent product.

The unmasking of palladiumchelate of 8-hydroxy-5-quinolinesulfonic acid by cyanide ions can be used through the formation of the strongly fluorescent chelate with magnesium to determine slow concentrations of cyanide (0.02 μg).



The formation of products with green fluorescence takes place in the reaction between cyanide ions and p-benzoquinone as well as various other quinone derivatives.



(1)

λ_{Ex} 400 bis 420 nm

λ_{Em} 480 bis 490 nm

Key: 1) to

With p-benzoquinone even 0.2 μg cyanide are detectable and with benzoquinonemonoxine-sulfonicester, 0.5 μg cyanide.

28.5.3.4. Other Colorimetric Methods

In the unmasking of the yellow palladiumchelate of 8-hydroxy-7-iodo-5-quinoline-sulfonic acid by cyanide ions in the presence of iron(III)- ions the blue color of the iron complex is produced with an absorption maximum of 650 nm.

Even 0.2 μg cyanide can be determined. Sulfide ions give a similar type of reaction.

In an indirect method mercury chloride in excess is added to the cyanide solution; the noncomplex bound mercury ions give with p-dimethylaminobenzylidenerhodanine a red color.

A colored compound suitable for colorimetric determination with an absorption maximum of 540 nm is formed in the reaction of cyanides with chloranilic acid or mercury chloranilite.

28.5.4. Quantitative Determination of Cyanogenhalides

The methods based on the formation of polymethine dyes is suitable for colorimetric determination (compare section 28.5.3.2.), while it is not necessary to add chloramines.

28.5.4.1. Determination of Cyanogenchloride by Reaction with Alkaline

The specimen solution is treated with an excess of adjusted soda lye. From the equation it is apparent that for each mol of cyanogenchloride 2 mols sodium lye must be used.

$$ClCN + 2NaOH \rightarrow NaCl + NaOCN + H_2O$$

The excess soda lye is then titrated again with sulfuric acid using phenolphthalein as indicated.

28.5.4.2. Determination of Cyanogenbromide

The method is based on the reduction of cyanogenbromide with sodiumthiosulfate in acid solution.

$$BrCN + 2S_2O_3^{2\ominus} + H^{\oplus} \rightarrow Br^{\ominus} + HCN + S_4O_6^{2-}$$

Procedure:

The maximum 0.05 molar solution of cyanogenbromide in 0.5 normal sulfuric acid is quickly treated with the same volume of 0.1 normal thiosulfate solution. After adding a starch solution 0.1 normal iodine solution is added until the color becomes blue, then titrated with thiosulfate solution until discoloration.

28.6. Halogen Derivatives of Carbonic Acid

The military chemists are interested primarily in the problem of the detection of the most important representative of this group of poisons, phosgene in the air. Some detection papers, chalks and tubes are described therefore in section 32.2.

28.6.1. Qualitative Method of Detection for Phosgene

28.6.1.1. Detection with Aniline Water

In the reaction of phosgene with aniline diphenylurea is formed with a melting point of 235 degrees C.

$$COCl_2 + 4C_6H_5NH_2 \rightarrow CO(NHC_6H_5)_2 + 2C_6H_5NH_2 \cdot HCl$$

Reagents:

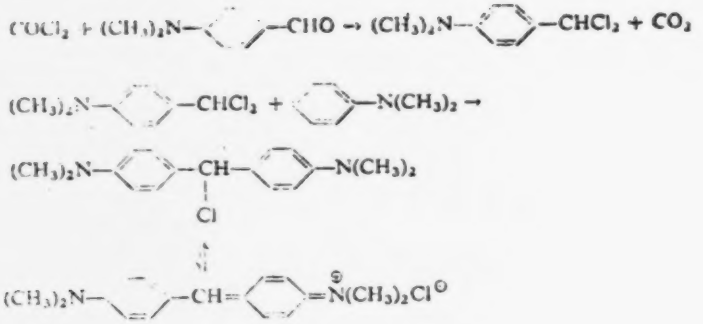
4 g aniline are agitated with 100 ml water. After 1 hour it is filtered through a filter moistened with water, the solution is treated with diphenylurea, agitated and filtered once again.

Procedure:

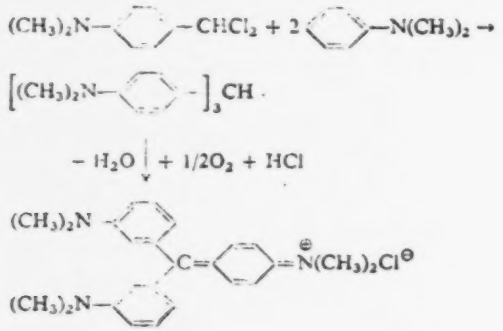
The air containing phosgene is sucked up through the reagent solution in a washing flask. A white turbidity or precipitate indicates the presence of phosgene. The limiting concentration is at 0.05 mg/ml.

28.6.1.2. Color Reaction with p-Dimethylaminobenzaldehyde and Dimethylaniline [75]

In this reaction suitable for test tubes probably a blue-green diphenylmethane dye is produced.

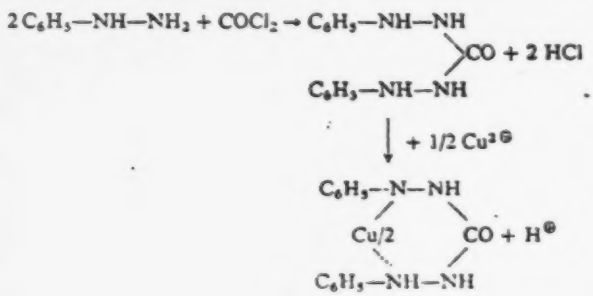


At the same time through a secondary reaction there appears to be formation of the leucobase of crystal violet, which is transformed into crystal violet by oxidation.



28.6.1.3. Detection by Formation of Diphenylcarbazide [76]

In this spot reaction from phosgene and phenylhydrazine diphenylcarbazide is formed which gives with copper salt an intensely violet internal complex.



Reagents:

Cinnamic phenylhydrazine.

Copper sulfate, 1 percent solution.

Procedure:

In the depression of a spot plate 1 drop of the phosgene solution (in ether, chloroform, carbontetrachloride) is mixed with a small grain of the cinnamic phenylhydrazine.

After 5 minutes 1 drop of copper sulfate solution is added. The presence of phosgene is indicated by a reddish-violet to pink color.

Limiting Concentration: 0.01 mg phosgene per milliliter specimen solution can be detected.

28.6.2. Quantitative Determination

28.6.2.1. Iodometric Determination

In the absorption or dissolution of phosgene in saturated acetone sodium iodide solution iodine is separated.

$$COCl_2 + NaJ \rightarrow 2\,NaCl + J_2 + CO$$

The acetone used must be dried for several days over calcium chloride, since the reaction of phosgene with potassium iodine takes place quantitatively only in the absence of water.

Procedure:

An ampule with about 0.4 g liquid phosgene is placed in a carefully dried 500 ml vessel. 5 g sodium iodide and 30 ml acetone are added to it. After sealing the flask the ampule is destroyed by fast swiveling. After violent agitation the flask is allowed to stand in the darkness for 15 minutes and then the iodine separated is titrated with 0.1 normal sodium thiosulfate solution. Parallelly the thiosulfate consumption of a control test is also determined, set up with equal amounts of iodide and acetone. The phosgene content is calculated as follows:

$$\% \text{ phosgene} = \frac{(A-B)\ 4.95 \text{ by } 100}{\text{weight in milligrams;}}$$

A = consumption of specimen of 0.1 n Na2S20 (ml)
B = consumption of the control test for 0.1 n Na2S203 (ml).

The presence of free chlorine dissolved in the phosgene falsifies the values obtained. The free chlorine is determined by the dissolution of phosgene in a soda solution, subsequent addition of sodium iodide and titration of the iodine separated after acidulation with thiosulfate.

In the determination of phosgene in the form of vapor before the absorption in the acetone free chlorine and hydrogenchloride can be removed by washing the gas current with concentrated sulfuric acid and sending it through a calciumchloride tube filled with metal antimony.

28.6.2.2. Colorimetric Determination with 4-(p-nitrobenzyl)-pyridine

Phosgene gives the reaction with 4-(p-nitrobenzyl)-pyridine [118] a yellow to orange biquarternary ammonium salt. To carry out the determination the air containing phosgene is sent for 1 minute through 6 ml of a solution of 20 mg 4-(p-nitrobenzyl)-pyridine in methylisobutylcarbinol. After 5 minutes colorimetry is carried out at 415 nm. The calibration curve forms a straight line in the range of 0.5 to 5 µg/ml. The sensitivity of the method is 0.1 to 0.2 mg phosgene per cubic meter of air.

Phosgene can be determined with the same sensitivity in the air if the reagent used is a solution of 0.25 percent 4-(p-nitrobenzyl)-pyridine and 0.5 percent N-benzylaniline in diethylphthalate [194].

28.6.2.3. Other Methods of Determination of Phosgene

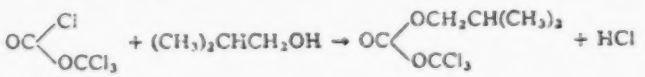
The reaction of phosgene with anilines in aqueous solution is quantitative and the deposit of diphenylurea can be weighed for the gravimetric determination. In the transfer of a current of air containing phosgene over silver wool at 800 degrees C besides silver chloride, carbon monoxide is formed which is collected in the nitrometer on potassium lye and can be measured.

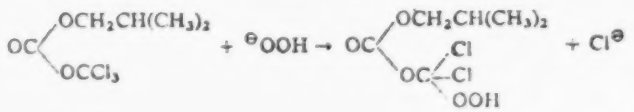
In the reaction with hexamethylenetetramine bis-mexamethylene urea is formed.

After the distillation of water vapor from the alkaline solution the excess of hexamethylenetetramine is titrated with lye using a mixed indicator of methyl red/methylene blue. Chlorine and hydrochloric acid do not disturb the determination. Several older methods of determination are based on the titration of the chloride formed in the hydrolysis with soda lye with silver nitrate or the hydrochloric acid formed in the hydrolysis with water by means of lye.

28.6.2.4. Colorimetric Determination of Diphosgene [77]

In the detailed description of the Schoenemann reaction (28.1.1.1.) it was indicated that acid chlorides are also involved in this reaction. This fact may be used to determine the chlorine carbonic acid trichloromethylester (diphosgene). Reproducible results are obtained if the chemical warfare agent is dissolved in isobutanol and this solution stable for several hours is used for the subsequent determination. Trichloromethylcarbonic acid isobutylester, from which it is most probable that the alkaline hydrogen peroxide solution will give off one or several chlorine atoms with the formation of peroxide. The latter then cause the oxidation of amine





Reagents:

o-dianisidine, 1.2 percent solution in acetone, which is produced fresh everyday.

Sodiumperborate, 0.25 percent solution in water.

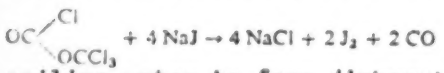
Procedure:

Three ml of the solution of the warfare agent in dehydrated isobutanol are added to a mixture of 2 ml o-dianisidine and 3 ml sodiumperborate solution. After mixing and

after 5 minutes in the colorimeter at 450 nm the extinction is measured compared with a control test. The evaluation takes place with a calibration curve, which follows in the concentration range 2 to 10 µg the Beer's law. To determine higher concentrations (40 to 120 µg) we use as oxidizable reagent 2 ml of a 0.25 percent solution of indol in acetone. After 10 minutes 15 drops of aniline are added to resolve the indigo formed; thereafter the extinction is measured at 630 nm.

28.6.2.5. Other Methods of Determination of Diphosgene and Triphosgene

Similarly to phosgene diphosgene can be determined by release of iodine from acetone-sodiumiodide solution; with triphosgene the reaction is not stoichiometric.



$$OC\begin{matrix}Cl\\ \diagdown\\ \diagup\\ OCCl_3\end{matrix} + 4\,NaJ \rightarrow 4\,NaCl + 2\,J_2 + 2\,CO$$

Both poisons react with aniline water to form diphenylurea, which can be determined gravimetrically. The conversion factor is according to the variation of the reaction 0.4661 for diphosgene and triphosgene.

The hydrolysis of both the esters with separation of 4 equivalents of hydrochloric acid for diphosgene or 6 equivalents for triphosgene takes place only slowly in cold water, but quickly in hot.

28.7. Psychotoxic Warfare Agents (Psychological Poisons).

28.7.1. Indol Derivatives

28.7.1.1. Qualitative Detection

The color reactions described for the qualitative detection of the parent grain alkaloids can also be used for the indol substances of interest in military chemistry.

Keller Reaction

This color test for parent grain alkaloids was originally carried out by dissolving the specimen substance in glacial acetic acid which contains some iron(III)-chloride and providing for this solution a sublayer of concentrated sulfuric acid. On the boundary of separation of the two phases then a blue-violet ring is produced. Rieder and Boehmer were able to prove that the glyoxylic acid contained as impurity in the glacial acetic acids plays the decisive role in the mechanism of this color reaction.

Reagent:

Glacial acetic acid containing 0.05 percent iron(III)-chloride and 0.1 percent glyoxylic acid.

Procedure [106]:

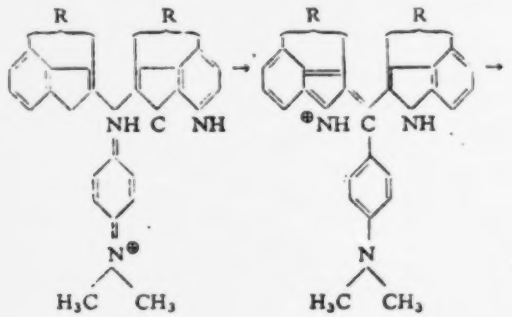
The specimen substance is dissolved in 1 ml reagent. A sublayer of concentrated sulfuric acid (free from nitrate) is provided carefully and after 15 seconds, it is agitated. LSD-25 (d-pysergic acid diethylamide) and other indol derivatives including psilocybin, dimethyltryptamine and bufotenine, give a stable blue color. This detection

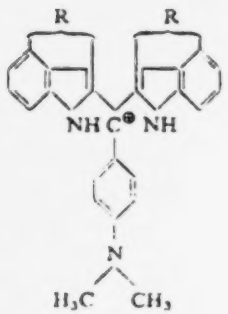
reaction is characterized by the high selectivity for indol derivatives with free two position on the indol nucleus.

Color Reaction According to Van Urk/Smith [107]

All parent grain alkaloids give with p-dimethylaminobenzaldehyde a blue color in strong sulfuric acid solution. A comparison of the absorption spectra of the blue colors which were obtained on one hand with the Van Urk/Smith color reactions of the parent grain alkaloids, on the other hand with the reaction of beta-indolylacetic acid with p-dimethylaminobenzaldehyde, allows the hypothesis that the limiting forms given below are probable for the blue color salt [108].

The color reaction is specific for alpha- and beta-unsubstituted indol derivatives and has been found suitable generally for detecting the LSD.





We find the composition of the reagent solution in the description of the quantitative determination (compare section 28.7.2.2.). 0.2 ml of the alcoholic specimen solution are treated with 0.2 ml water and agitation with 1 ml of the reagent solution. A blue color appears in the presence of more than 5 µg LSD.

Detection by UV Light

All derivatives of lysurgic acid are recognizable in solution and on chromatograms by the blue fluorescence in the UV light. The UV absorption spectrum typical for these compounds and which is characterized by a smooth maximum of 316 to 318 nm and a minimum at 268 nm does not permit naturally any differentiation between the different derivatives.

28-7.1.2. Quantitative Determination

Keller Reaction

The photometric determination takes place with the modified Keller reagent modified by Rieder and Boehmer [120].

Reagents:

40 ml of a 0.25 percent solution of sodiumglyoxylate in water, 0.165 ml of a 2 percent iron(III)-chloride solution ($FeCl_3.6H_2O$) and 60 ml concentrated sulfuric acid are mixed under cooling. The reagent can be stored for about 2 weeks if kept in a dark flask.

Procedure:

3 ml of the reagent are added to 0.5 ml of the aqueous solution of the indol derivatives (1 to 3.10-4 M). After the mixing the reaction mixture is left for 3 minutes in a boiling water bath, then allowed to cool to room temperature and at 650 nm (LSD-25) or 540 nm (psilocybin) the extinction is measured. The evaluation takes place on the basis of a calibration curve.

Van Urk/Smith Reaction

The reagents standardized by Allport and Cocking [109] is generally applicable for the photometric determination.

Reagent:

125 mg p-dimethylamidobenzaldehyde are dissolved in 100 ml 65 percent sulfuric acid and treated with 0.1 ml 5 percent iron(III)-chloride solution. The reagent can be stored for about 2 weeks if kept in the dark.

Procedure:

0.5 ml of the alcoholic specimen solution are treated with 0.5 ml water and under cooling in the ice bath with 2 ml reagent in drops. After 1 hour standing in the dark at room temperature the extinction is measured at 550 nm against a control test. The method allows the determination of 10 to 60 µg LSD.

Fluorimetric Determination of LSD-25 [110]

The preparation of the sampling material for this most sensitive method of determination takes place as follows:

20 ml of the specimen water or an aqueous extract are extracted after adjusting the pH value to 8.5 to 9 three times, each time with 15 ml chloroform. The combined chloroform extracts are agitated for 5 minutes with 5 ml 0.01 normal hydrochloric acid. The aqueous phase is separated, alkylized with diluted soda lye and extracted with 10 to 15 ml chloroform. The solvent is evaporated in water bath and the residue dissolved in

methanol. The methanol solution is applied on a plate coated with silica gel and the substances contained in the solution are separated by thin layer chromatography. A mixture of trichloroethane and methanol (9 to 1) is used as working medium. The LSD spots visible in the UV light through blue fluorescence are eluted with methanol. For the quantitative fluorimetric measurement monochromatic ultraviolet light of wavelength 313 nm is used for the excitation, the fluorescence light is measured at 408 nm, at 445 nm in aqueous solution. In the range of 0.01 to 1 µg LSD/ml there is linear relationship between the fluorescence light and the concentration.

28.7.2. Quinuclidylbenzilate (BZ)

BZ is the benzilic ester of quinuclidinol. It is detectable analytically through known methods of detection for benzylic acid and tertiary nitrogen.

28.7.2.1. Qualitative Detection

Color Reaction with Sulfuric Acid

Von Welch and Smith [114] observed that benzylic acid produces colored cations when dissolved in concentrated sulfuric acid. This fact can be used to identify BZ in the presence of solid specimen substances on thin layer chromatograms.

Some crystals of the specimen substance are treated in a small porcelain dish with a few drops of sulfuric acid and heated. BZ causes a strong red color. It may be noted that adamsite and the alkaloid veratrine give similar colors.

Color reactions are also observed with other alkaloid reagents containing sulfuric acid. With the Marquis reagent (formaldehyde-sulfuric acid) and the Meckes reagent (selenic acid-sulfuric acid) a dark blue color is obtained, and with the Froehdes reagent (molybdate-sulfuric acid) a reddish-violet color.

Other Possibilities of Detection

a) Dragendorff reagent causes in a solution an orange-red deposit, and an orange color on the chromatogram in the presence of BZ.

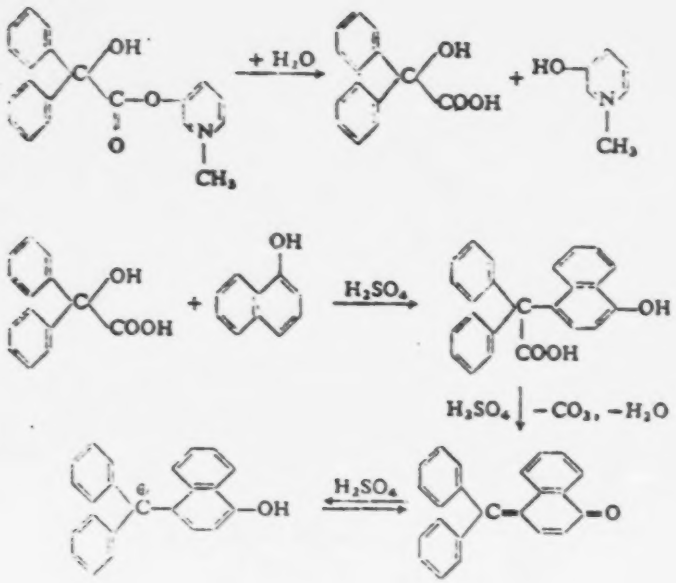
b) The naphthofuchsone reaction described in 28.7.2.2. can be used in the same way for detection. The limiting concentration is 5 µg/ml.

28.7.2.2. Quantitative Determination

Colorimetric Determination as Naphthofuchsone

The benzylic acid obtained in the alkaline hydrolysis of the BZ can be determined spectrophotometrically by a method developed by Kramer and Hackley [115]. Benzylic acid condenses with alpha-naphthol in the presence of concentrated sulfuric acid into a naphtholfuchsone dye.

The hydroxytriarylmethyl cation which has the purple color in a mixture of glacial acetic acid and concentrated acid has a high extinction coefficient at 558 nm.



Reagents:

Soda lye, 0.05 normal.

Alpha-naphthol, 0.04 g dissolved in 250 ml concentrated acetic acid.

Concentrated sulfuric acid.

Procedure:

5 ml of the alcoholic specimen solution are treated with 0.5 ml soda lye and evaporated carefully until dried. 0.5 ml naphthol solution and 1 ml sulfuric acid are added to the residue. After 5 minutes acetic acid are used to fill up to 3.5 ml and the specimen is tempered at 25 degrees C. The extinction is measured at 558 nm against a control test which was set up with the reagents. The evaluation is carried out on the basis of the calibration curve. In the qualitative evaluations there is no need of filling up with acetic acid.

28.8. Irritating Warfare Agents Which Do Not Contain Arsenic

28.8.1. Halogenated Ketones

To detect these poisons a reagent with vanilline is suitable.

Reagents:

0.1 g vanilline is dissolved in 7.5 ml concentrated acid, 2.5 ml concentrated sulfuric acid is added carefully. The reagent is freshly produced each time before use.

Procedure:

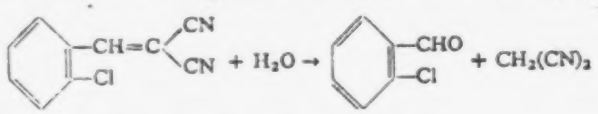
1 ml of the solution of chemical agent in carbontetrachloride is treated with 1 ml reagent and agitated. In the presence of the above-mentioned aliphatic ketones the following colors are observed:

red, gradually blue	bromomethylethylketone
red, gradually greenish-blue to greenish black	chloroacetone
green	bromacetone

When heating in water bath bromomethylethylketone and chloracetone produce a fast blue color. When the test is negative or has a slight yellowish color the three irritants are definitely absent.

28.8.2. 2-Chlorobenzylidenemalondonitrile (CS)

The white crystalline structure is easily soluble in acetone, benzol and chloroform, less soluble in alcohol, carbon tetrachloride and ether and hardly soluble in water, petroleum ether and carbondisulfide. Water hydrolyzes the compound only slowly; the addition of lyes causes a strong acceleration of hydrolysis.



28.8.2.1. Qualitative Methods of Detection

Detection with m-Dinitrobenzol

Procedure:

1 ml of the alcoholic specimen solution is treated with 0.1 ml 1 percent m-dinitrobenzol solution in alcohol and 0.2 ml 30 percent aqueous potassium lye and heated. A reddish-brown color occurring at high concentrations, and at low concentrations a color which is first reddish-violet then orange shows the presence of 2-chlorobenzylidenemalono-dinitrile. The limiting concentration is 1 µg/ml. Chloracetophenone, bromobenzyl-cyanide, and chloracetone gives similar colors (see section 28.8.3.1.).

Reaction with Quinones

The color reactions of 2-chlorobenzylidenemalonodinitrile with different quinones can be used for detection in solutions, chromatograms and in the air by means of indicator tubes. With p-benzoquinone, a blue color is found, with tetrachlorobenzoquinone (chloranil) a bluish-green color, with 1,2-naphthoquinone a reddish-violet and with 1,4-naphthoquinone a bluish-violet color is obtained.

Reagent:

Sodium 1,2-naphthoquinone-4-sulfonate, 0.002 percent in water.

Procedure:

1 ml of the specimen solution is treated with 0.5 ml reagent and 1 drop of 1 normal soda lye. A reddish-violet color which remains stable in the acidulation with acetic acid indicates the presence of 2-chlorobenzylidenemalonodinitrile. The limiting concentration is 0.001 mg/ml. The similar colors caused by higher concentrations of chloracetophenone and bromobenzylcyanide disappear in the acidulation with acetic acid.

Detection with benzofurazoneoxide solution in ethanol and 0.5 ml 1 N soda lye. In the quantitative determination subsequently water is used to fill to 10 ml. A violet color shows the presence of CS. The photometric measurement takes place after 20 to 30 minutes at 580 nm.

The reagent is suitable for detecting CS on paper and thin layer chromatograms and for application as spot test on reagent paper, while 0.5 g/cm2 can be detected.

Ultraviolet Spectrophotometric Detection

Aerosols collected on air filtering paper can be detected by ultraviolet spectral photometry at 260 nm [119].

28.8.2.2. Quantitative Determination

Colorimetric Determination with Chloranil [113]

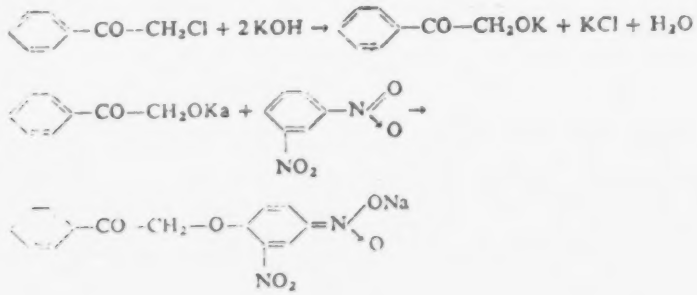
The extinction of the color which occurred in the reaction of CS or its product of hydrolysis malonic acid dinitrile with chloranil in the presence of ammonia is measured at 680 to 700 nm. The limiting concentration for CS if 2 µg/ml for malonic acid dinitrile 1 µg/ml.

28.8.3. Chloracetophenone

28.8.3.1. Qualitative Detection

Color Reaction with m-Dinitrobenzol

A general reaction for detection of compounds with active methyl group, including the chemical warfare agents chloracetophenone and bromobenzylcyanide is the color reaction with m-dinitrobenzol in the presence of alkalis [78]. The explanation for the color formation is most probably the quinoid structure in the salt of a nitrolic acid.



Reagent:

m-Dinitrobenzol, 1 percent solution in ethanol.

Potassium lye, 30 percent.

Procedure:

1 ml of the alcoholic specimen solution is treated with 0.5 ml reagent and 3 to 5 drops of alcoholic potassium lye. A reddish-violet color indicates the presence of chloracetophenone and 2-chlorobenzylidenemalonodinitrile. Bromobenzylcyanide is detected by a reddish-brown color and chloracetone by the solution becoming red. In case of negative results for the specimens, these poisons are definitely not present. A differentiation is possible by acidulation of the reaction mixture with acetic acid. The color caused by chloracetophenone disappears immediately. In the presence of the irritant CS the color is stable. Limiting concentration: 0.001 mg chloracetophenone per milliliter are detectable.

Nitration to Dinitrobenzoic Acid

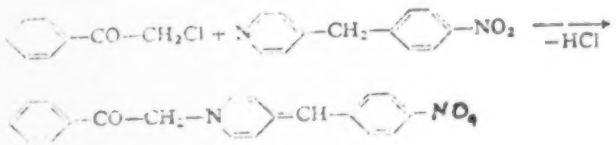
By means of nitric acid chloracetophenone can be nitrated to dinitrobenzoic acid. The latter is detectable after reduction in the form of colored ammonium salts of diaminobenzoic acid [79].

Procedure:

In the test tube a few crystals of the substance are covered with 0.5 to 1 ml concentrated sulfuric acid with the addition of a few crystals of potassium nitrate and heated with the burner for a short time until the development of brown vapors. After cooling the mixture is poured into a small beaker with 2 to 3 ml water and treated with 10 ml 15 percent ammonia and hydroxylamine hydrochloride on the tip of the spatula. Chloracetophenone is identified through a reddish-brown to red color. It may be necessary to heat briefly on the water bath.

Detection with 4-(p-Nitrobenzyl)-pyridine [80]

With 4-(p-nitrobenzyl)-pyridine chloracetophenone produces in ethanol solution and with the addition of dimethylformamide a red color whose production is explained by the following reaction.



28.8.3.2. Quantitative Determination

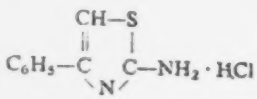
Colorimetric Determination with Pyridine [80]

With pyridine chloracetophenone reacts with the formation of a yellow phenazylpyridium-chloride.

The chloracetophenone contained in the air as vapor or aerosol is absorbed in a pyridine-dimethylformamide mixture. By heating in the water bath the color is produced. The addition of piperidine stabilises the color which is colorimetrized after 15 minutes at 450 nm. The calibration curve shows a straight line in the concentration range of 1 to 25 Ag/ml. In the absorption from 10 l air it is possible still to detect 0.6 mg/m3.

Reaction with Thiourea /80/

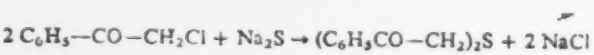
Possibilities to determine chloracetophenones are obtained through the reaction with thiourea which takes place with formation of the hydrochloride of the 2-amino-5-phenylthiazole.



The reaction which is quantitative can be evaluated by volumetric determination of hydrochloric acid or by colorimetry of the colored product occurring in the combination with diazo-p-nitraniline.

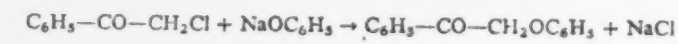
Separation of Chlorine with Sodium Sulfide.

When chloracetophenone is heated in alcoholic solution with sodium sulfide, a chloride is formed which is determined argentometrically according to the method of Volhard. Before the titration it is necessary to remove the disturbing sulfide residues by boiling after acidulation and oxidation with hydrogen peroxide.



Reaction with Sodiumphenolate

In the reaction which takes place stoichometrically with sodiumphenolate, sodium chloride is produced which is also titrated argentometrically according to the method of Volhard.



28.8.4. Bromobenzylcyanide

28.8.4.1. Qualitative Methods of Detection

Separation of Cyanide

When melting with alkalihydroxide or in the treatment with alcoholic alkaline lye in cold conditions bromobenzylcyanide gives off cyanide which can be detected by the usual methods (compare section 28.5.) The Berlin blue method is very suitable.

Reaction with o-Dinitrobenzol

In the presence of alkali with o-dinitrobenzol bromobenzylcyanide gives a colored reaction which can be used for sensitive detection.

Reagents:

o-Dinitrobenzol, 1 percent in ethanol.

Potassium hydroxide, 30 percent.

Procedure:

1 ml of the alcoholic specimen solution is treated with 0.5 ml o-dinitrobenzol solution and 1 drop of potassium hydroxide. Bromobenzylcyanide produces a violet color, which disappears in the acidulation with acetic acid.

The limiting concentration is at 0.001 mg/ml. Chloracetophenone reacts in the same way (limiting concentration 0.05 mg/ml), while o-chlorobenzylidenemalonodinitrol gives an orange color which is stable when acidulated with acetic acid.

Saponification to Ammonia

Bromobenzylcyanide is saponified under heating both with alcoholic alkali lyes and by acidulation with formation of ammonia.

$$2\,C_6H_5CHBrCN + 4\,KOH \rightarrow C_6H_5{-}C(=C_6H_5){-}COOK + 2\,KBr + 2\,NH_3$$

$$C_6H_5CHBrCN + 2\,H_2O + HCl \rightarrow C_6H_5CHBr{-}COOH + NH_4Cl$$

The ammonia can be detected with Nessler's reagent. Since ammonia is volatile in alcoholic solution, we recommend saponification with acid which is produced by concentration of the alcoholic specimen solution after adding 1 drop of concentrated hydrochloric acid, until dry. The residue is absorbed with somewhat diluted sodium hydroxide and after adding the Nessler reagent the bromobenzylcyanide is identified by the light brown color or a precipitate of the same color.

In the acidulation of the reaction mixture after the alkaline saponfication, a crystalline deposit of diphenylmaleic anhydride is formed with melting point 156 degrees C.

Other Possibilities of Detection

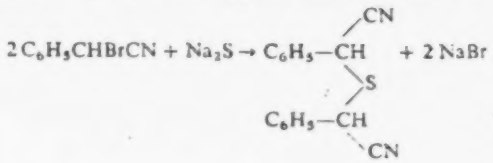
When heating a few crystals of the chemical warfare agent with concentrated sulfuric acid a brownish-red color is found of unknown origin which can be distinguished clearly from the carmine red test color obtained with adamsite. The irritant xylylbromide is indicated with a red color.

Then the chemical agent is heated with a sodium picrate solution which was obtained by dissolution of 0.5 g picric acid in 100 ml 2 normal sodium hydroxide, a red color is obtained. It is due to the formation of the sodium salt of isopurpuric acid and is obtained with all agents which give off cyanide, therefore also with diphenylcyanoarsine and tabun.

28.8.4.2. Quantitative Determination

Reaction with Sodium Sulfide

In the quantitative reaction with sodium sulfide in alcoholic solution bromine is separated as bromide with formation of bis-(phylacetonitrile)-thioether, and can be titrated argentometrically according to the method of Volhard.



The sulfide excess must be removed before the titration by boiling the solution acidulated with sulfuric acid and oxidation of the residual hydrogen sulfide with hydrogen peroxide.

28.8.5. Trichloronitromethane (Chloropicrin)

28.8.5.1. Qualitative Methods of Detection

Reduction to Nitrite

According to Aleksevskii, chlorpicrin is reduced by treatment with metal calcium or sodiumamalgam to nitrite. $CCl_3NO_2 + 8H \rightarrow HNO_2 + 3\,HCl + CH_4$

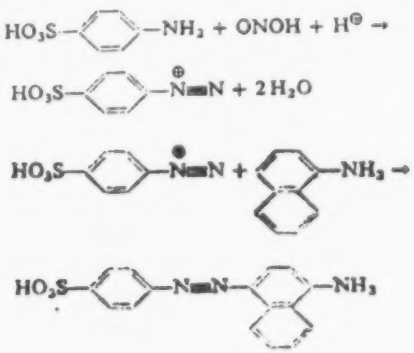
In the reaction with sodiumethylate, with methanol potassiumiodide solution or with alklye also nitrite is formed in the presence of hydrogen peroxide.

$$CCl_3NO_2 + 4\,C_2H_5ONa \rightarrow C(OC_2H_5)_4 + 3\,NaCl + NaNO_2$$

$$CCl_3NO_2 + 4\,KJ \rightarrow CJ_4 + 3\,KCl + KNO_2$$

$$CCl_3NO_2 + 6\,NaOH \xrightarrow{(H_2O_2)} Na_2CO_3 + 3\,H_2O + 3\,NaCl + NaNO_2$$

The detection of the nitrite produced is achieved with the Griess reagent, which contains alpha-naphthylamine and sulfanilic acid. The sulfanilic acid is diazotized through the nitrite, the diazonium salt is combined with the amine into a red azo-dye.



Reagents:

For reduction

Sodiumamalgam, 8 percent
metal calcium
metal sodium
powdered Devarda alloy or potassiumiodide, saturated in methanol.

Griess Reagents:

Solution A (0.1 g sulfanilic acid is dissolved in 100 ml 30 percent acetic acid)

Solution B (0.03 g alpha-naphthylamine is boiled with 70 ml water, filtered or decanted from the undissolved residue and treated with 30 ml glacial acetic acid).

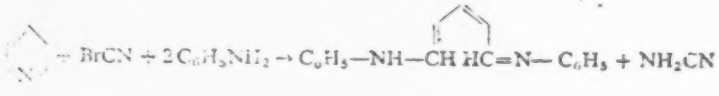
Before using equal parts of both solutions are mixed.

Procedure:

5 ml of the alcoholic solution of the chemical agents are treated with 1 ml of the reducing agent. After the reduction is completed acetic acid is used for acidulation. A red color produced after addition of 1 to 2 ml Griess reagent indicates the presence of chloropicrin.

Reaction to Thianogenbromide [81]

Chloropicrin is converted by potassiumcyanide in the presence of potassiumbromide in alcoholic solution to tetradinitropotassiumethane and cyanogenbromide. The cyanogenbromide form reacts with pyridine and aniline with the formation of a red polymethine dye. Further data on the mechanism of this reaction may be found in the description of the methods of detection for cyanichalides (see section 28.5.2.1.).



Reagents:

0.5 g each of potassiumbromide and potassiumcyanide are dissolved in 8 ml water and the solution is filled with ethanol up to 20 ml.

Pyridine

Anilinehydrochloride, 10 percent solution in water.

The complete reagent is produced each time shortly before use by mixing two parts of potassiumbromide cyanide solution and 1 part each of pyridine and anilinehydrochloride solution.

Procedure:

For the detection in the air the latter is sucked up through a washing flask filled with the reagent. Chloropicrine is according to concentration indicated by a yellow, orange, or red color. A sensitivity of 0.3 to 0.4 mg/l air is achieved.

To detect chloropicrine in water or in alcoholic extracts the following procedure is applied.

1 ml of the specimen solution is treated with 0.5 ml of KBr-KCN solution and with 0.5 ml of a mixture of 2 ml pyridine, 0.2 ml ethylacetoacetate and 8 ml water. An orange-red color indicates the presence of chloropicrin. The limiting concentration is 0.001 mg/ml.

Other Possibilities of Detection

If the air to be studied is allowed to flow through an alcoholic solution of thiophenol in the presence of chloropicrin a white turbidity or opalescence is formed, which comes from the diphenyldithioether produced. A concentration of 0.06 mg/l can be identified after suction of 2 l air after 3 to 4 minutes.

A 10 percent solution of dimethylaniline in benzol shows in the suction of air containing chloropicrin a change of color from yellow to red. By adding a few drops of hydrogen peroxide and heating the color is intensified.

With potassium salts of mercaptanes chlorpicrin reacts with formation of insoluble condensation products. This reaction can be used for detection by allowing the air to be studied to pass through an alcoholic solution of the potassium salt of dithioethyleneglycol and obtaining a yellowish deposit.

A few drops of the chemical warfare agent or alcoholic extract are boiled with 2 ml 5 percent alcoholic potassiumhydroxide and a crystal of thymol or resorcinol is added. In the presence of chloropicrin we obtain with thymol a yellow color and a red one with resorcinol. The yellow color obtained with thymol is converted into reddish-violet when sulfuric acid is added.

28.8.5.2. Quantitative Determination

Argentometric Determination After Decomposition to Chloride

The decomposition can take place by several methods. Besides the reactions with alcoholic alkali lyes and alkaline alcoholates chloride is also formed in stoichiometric quantities in the conversion with sodiumsulfite and with sodium peroxide.

$$CCl_3NO_2 + 3\ Na_2SO_3 + H_2O \rightarrow CHNO_2(SO_3Na)_2 + 3\ NaCl + NaHSO_4$$

It is advantageous to use sodium peroxide which oxidizes simultaneously all the colored organic compounds produced into colorless ones, which makes it easier to obtain the final determination of the Volhard titration.

Procedure:

In a solution of 1.5 g sodium peroxide in 50 ml 50 percent ethanol, a weighed portion of 0.1 to 0.2 g of the chemical agent is added. It is heated in the reflux cooler until it is discolored, which requires about 1.5 to 2 hours. After adding 20 ml 2 normal sodium peroxide without any cooling it is boiled for 30 minutes more. The cooled solution is acidulated with 30 ml 2 normal nitric acid, then the chloride is determined by the usual method according to Volhard.

Colorimetric Determination of the Cyanichalide

On the basis of the described method of qualitative detection two colorimetric methods were developed to determine chloropicrin in water and in the air [82].

Determination in Water

Reagent:

50 ml pyridine, 50 ml methanol and 0.6 g potassiumcyanide are agitated together with cooling under ice for 30 minutes. After filtering away the undissolved potassium-cyanide we add 0.1 g phloroglucine. The reagent must be prepared freshly each time and kept in a brown bottle.

Procedure:

5 ml of the water specimens are agitated twice each time with 3 ml ligroin. 2 ml reagent are added to the combined extract. After 5 minutes the reddish-violet color is colormetrized at 535 nm against a controlled experiment.

The limiting concentration is 0.005 mg/ml water.

Determination in the Air

Reagent:

20 ml pyridine, 70 ml methanol and 0.4 g potassiumcyanide are agitated with ice cooling for 30 minutes and treated after filtering the undissolved cyanide with 0.8 g dimedon (5,5-dimethyldihydroresorcinol).

Procedure:

The air to be studied is sucked up slowly (2 l in 15 minutes) into a washing flask filled with 5 ml methylglycol. After adding 2 ml reagent the heating is carried out in a boiling water bath for 5 minutes and after cooling the orange to red color produced is colorimetrized at 490 nm. The limiting concentration is 0.4 γg/ml solution.

28.9. Carbon Monoxide

The strong reduction capacity of carbon monoxide is the basis of most methods of detection and determination.

28.9.1. Reduction of Palladiumchloride

Carbon monoxide reduces palladiumchloride with the formation of elementary palladium.

$$Pd^{2\oplus} + CO + H_2O \rightarrow Pd + CO_2 + 2\,H^{\oplus}$$

A reagent paper impregnated with palladium chloride is colored gray to black in the presence of only 0.01 to 0.03 percent carbon monoxide in the air.

The detection becomes much more sensitive by additional use of phosphoromolybdic acid. Whereas carbon monoxide reacts only very slowly otherwise with phosphoromolybdic acid, in the presence of palladiumchloride molybdenum blue is produced immediately. The explanation resides in the adsorption and thus activation of carbon monoxide by the palladium formed. Through this heterogeneous catalysis, the reaction is accelerated.

$$2\,MoO_3 + CO \rightarrow Mo_2O_5 + CO_2$$

This system of reagents can be used in test tubes or as spot reaction for the detection of carbon monoxide which is formed in the decomposition of certain organic compounds with syrupy phosphoric acid or metal carbonyls with concentrated sulfuric acid.

Reagent:

0.02 g palladiumchloride are dissolved with 2 drops of concentrated hydrochloric acid and filled with water up to 10 ml. Of this solution 2 ml are mixed with 8 ml of a cold saturated solution of phosphoromolybdic acid in water [90, page 331].

Procedure:

A drop of the reagent solution is introduced in the decomposition vessel on a glass rod or on the stopper. After the action the drop is spread on the paper and a drop of water is applied. The blue coloring indicates the presence of carbon monoxide. Sulfur dioxide, hydrogen sulfide and hydrocyanic acid disturbs the detection. The detection with NBS indicator gel /94/ is based on the same principle. On silica gel impregnated with palladiumsulfate and ammoniummolybdate yellow silicomolybdate is formed which under the effect of carbon monoxide is reduced to the greenish-blue heteropoly compound. The sensitivity is 0.001 percent carbon monoxide. The reduction of the phosphoromolybdic acid can be used also for the photometric determination of carbon monoxide.

28.10. Fluorocarbonic Compounds

The stability of the C-F bond is characteristic of these poisons which are important because of their high oral toxicity especially for drinking water poisoning.

28.10.1. Methods of Wualitative Detection

28.10.1.1. Separation and Detection of Fluorine

A generally applicable method to separate fluorine is heating with sodium alcoholates. To achieve a high reaction temperature and as a result shorter separation time, alcohols with 6 to 8 carbon atoms, preferably hexanol are used [103]. An exactly weighed amount (10 to 20 mg) of the fluorein compound is dissolved in a vessel provided with reflux

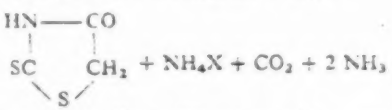
cooler in 15 ml hexanol and heated for 15 minutes up to boil after adding 0.2 g metal sodium. The still hot solution is extracted twice in a separating funnel each time with 10 ml water. In the aqueous extract then fluorine is determined qualitatively or quantitatively with one of the usual methods (compare chapter 26.2). To detect the vapors of fluororganic compounds in the air hexanol can be used as absorption medium in wash bottles with the subsequent application of this procedure. In the presence of fluorine compounds in the water specimens the separation of fluorine is achieved by heating with a mixture of potassiummetaperiodate, silver perchlorate and perchloric acid.

The fluorine separated is distilled away after adding glass wool from the reaction mixture in the form of fluosilicic acid. The mineralization with calcium oxide was used to establish fluorine in fluoracetic acid, but uncontrolled losses of fluorine were observed, presumably because of the formation of fluoromethane. The digestion in the nickel cylinder according to the method of Wurzschmitt with sodium peroxide adding a little glycerine is very suitable.

28.10.1.2. Detection as Rhodanine

Feigl /93/ described a sensitive detection for monochloracetic and monobromacetic acids, which is based on a color reaction of the rhodanine formed in the heating with ammonium thiocyanate with quinones.

$$XCH_2COOH + 2\,NH_4SCN + H_2O \rightarrow$$



$$+\,NH_4X + CO_2 + 2\,NH_3$$

under more serious conditions monofluorfluoracetic acid also reacts.

Reagents:

Ammoniumthiocyanate, 1 percent in water.
1,2-naphthoquinone, 0.05 percent in 50 percent ethanol.

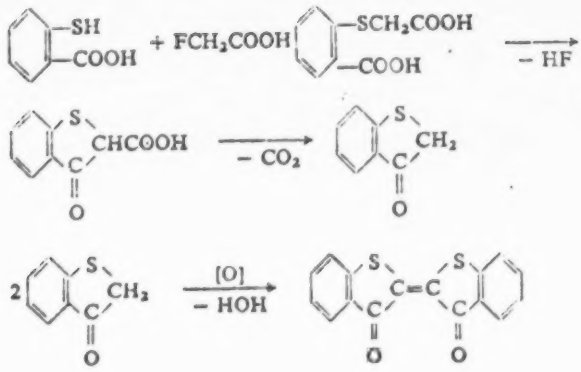
Procedure:

1 ml of the aqueous specimen solution is treated in a small beaker with 0.2 ml of the ammoniumthiocyanate solution and heated for 30 minutes in the drying case to 140 degrees C. After cooling 0.1 ml naphthoquinone solutions and 0.5 ml 0.2 percent sodium hydroxide are added to the residue. At latest after 5 minutes we compare with a control experiment set up simultaneously. A pink, red to reddish-violet color indicates the presence of fluoracetate.

The limiting concentration is 0.002 mg/ml.

28.10.1.3. Detection by Formation of Thioindigo

Similarly to the Friedlaender thioindigo synthesis in the heating of monofluoracetic acid and their salts with thiosalicylic acid and alkali, thioindoxyl is formed, which is oxidized into red thioindigo by means of potassiumhexacyanoferate (III).



A critical element in the success of the reaction is reaching a certain temperature in the melting of the alkali, for which Ramsey and Patterson /104/ considered 100 degrees C as too low and which according to experience should be about 200 degrees C. The reagents needed for achieving a qualitative detection are indicated in section 28.10.2.

Procedure:

The water specimen is adjusted by means of diluted sodium hydroxide or sulfuric acid to a pH value of 5 to 7. 1 ml of this neutralized specimen solution is treated in a small porcelain dish with 1 ml thiosalicylic acid solution and 2 drops of sodium hydroxide (1 to 1) and evaporated until dry on an asbestos wire network over a gas burner. The residue is heated further for 5 to 10 minutes and should assume here yellowish color, but should never be reddish-brown. After cooling the residue is dissolved in 1 ml potassiumferricyanide solution. In the presence of fluoracetates according to the concentration a deposit with more or less reddish-violet color is formed of thioindigo which is visible at very low concentrations often only after standing for a long time.

Detection Limit:

According to this procedure it is still possible to identify 0.02 mg sodium fluoracetate.

A higher sensitivity can be achieved if we take a larger volume of the water specimen until the alkaline reaction against lackmus with sodium hydroxide, thereafter treating with 1 ml thiosalicylic acid reagent and evaporating until dry.

28.10.1.4. Detection with Concentrated Sulfuric Acid and Chromotropic Acid

Fluoracetic acid is like all monohalogenated acetic acids hydrolyzed under heating with concentrated sulfuric acid to glycolic acid, from which under the water extracting effect of sulfuric acid, carbon monoxide and formaldehyde are formed. Formaldehyde is detected through the sensitive color reaction with chromotropic acid. A similar reaction is obtained with the chlorinated phenoxyacetic acids used as herbicides. The detection limit is 0.1 μg fluoracetic acid.

28.10.2. Quantitative Determination

After the separation or mineralization of the compounds the quantitative determination of fluoride is possible with one of the ordinary volumetric, colorimetric or enzymatic methods (compare Chapter 26).

A photometric determination /105/ of monofluoracetic acid is based on the color reaction with thiosalicylic acid (compare section 28.10.1.3.).

Reagents:

Thiosalicylic acid (1 g thiosalicylic acid is dissolved in 7 ml 4 percent sodium hydroxide; water is used to fill up to 50 ml).

Potassiumhexacyanoferrate (III), 2 percent solution in water.

Procedure:

The water specimen or aqueous extract is treated with 1 normal sodium hydroxide until alkaline reaction to lacmus and evaporated in a porcelain crucible to a volume of about 5 ml. With 1 normal sulfuric acid it is adjusted to a pH value of 5 to 7, and after adding 1 ml thiosalicylic acid solution and 2 drops of sodium hydroxide (1 to 1) we heat for 20 to 30 minutes in the water bath. Thereafter the mixture is evaporated in an oil bath at 170 to 200 degrees C until dry and heated for 30 more minutes at this temperature. After cooling the residue is dissolved in 2 ml water and treated with potassiumferricyanide solution until it becomes yellow. The content of the crucible is transferred quantitatively to a separating funnel and the thioindigo formed is extracted by double extraction with toluene. The toluene extract is filled to the corresponding volume and photometry carried out at 540 nm against a control specimen. The evaluation is carried out on the basis of a calibration curve.

28.11. Alkaloids

28.11.1. Preparation for Analysis

Alkaloids are introduced as sabotage poisons to pollute foodstuffs and fodder and drinking water, so that the specimens to be examined may occur in the following forms:

a) Foodstuff and fodder
b) Water specimens
c) Aqueous extract
d) Pure substance of alkaloids.

Alkaloids are plant bases and contain predominantly nitrogen in a heterocyclic ring system, for example pyridine, piperidine, quinoline, pyrrolidine and others. Most alkaloids are tertiary bases, but few of them are primary, secondary and quarternary bases. With few exceptions the alkaloids are solid, crystalline, colorless substances of low alkalinity.

The identification possibilities available to the analyst of chemical warfare agents include group precipitation and color reagents and after evaluating these preliminary

experiments, various special detection processes for the individual alkaloids as well as the application of chromatographic methods of separation and detection.

The preparation for analysis depends on the type of specimen material and on the desired degree of identification. With the pure substance the general color reactions are carried out and after indication of the presence of a certain alkaloid have been obtained by this means, special detection reactions for the alkaloid concerned. The procedure is the same for water specimens and aqueous extracts using group precipitation reagents. Tables 28.4 and 28.5 should be of help to evaluate the preliminary experiments.

The alkaloids must be extracted from foodstuff and fodder and isolated after separating the disturbing contents. Then the procedure according to Stas/Otto very commonly applied in toxicological analysis is used, in which the different alkalinity of the alkaloids is taken for the classification in three groups. The specimen material is crushed, suspended in alcohol and after adding some tartaric acid or a little sulfuric acid is boiled with reflux for 15 minutes. After cooling it is filtered and the filtrate is concentrated greatly in the water bath. In the absorption with cold water the fats and resins are separated. Filtering is carried out and once again evaporation. The syrupy residue is agitated with absolute ethanol, while inorganic salts, proteins, peptones and dextrines are separated. After repeated filtering, evaporation of the alkaloid and recovery of the residue with some water, the solution of the alkaloid sulfates or tartarates is obtained. Then the group separation is carried out, if necessary without further preliminary treatment the group precipitation reagents are applied. The group separation takes place by extraction from alternating acid or alkaline medium. The first group contains the alkaloid extracted from the weakly acid solution. To separate them the above solution or the water specimen treated with tartaric acid is treated first with ether then with chloroform containing 10 percent ethanol. After the evaporation of the solvent we find in the residue of the ether extract among other substances picrotoxin and cantharidin, in that of the chloroform extract, colchizin and veratrine.

The second group contains the alkaloids of strongly basic nature which can be extracted with ether only after alkalyzing the aqueous solution with sodium hydroxide. After evaporating the ether we find in the residue among other substances atropine, nicotine, strichnine, and brucine, aconitine, physostigmine, coniine, and cocaine.

The last group consists of alkaloids with free phenolhydroxyl groups which give with sodium hydroxide phenolates soluble in water and cannot be extracted with ether. But they can be extracted with chloroform if after preliminary acidulation the aqueous solution is adjusted with ammonia to a weakly alkaline reaction. When using this group separation naturally the possibly occurring chemical agents are contained in the different extracts according to their basic or acid nature and must, as in the case for example of nitrogen yperide, VX and BZ, be taken into consideration when using the precipitation reagents.

28.11.2. Methods of Detection

28.11.2.1. Determination of the Melting Point

In the presence of the pure substance the melting point is obtained as far as possible with the micromelting point equipment under the microscope. Table 28.3 indicates the

melting points of some important alkaloids.

A previous purification of the substances is advisable. It is accomplished by dissolving in alcohol, filtering and evaporation until a syrupy consistency, recovery of the residue with water, and after alkalizing with sodium hydroxide, extraction with chloroform. The chloroform is evaporated and the residue used to determine the melting point.

Table 28.3. Melting Points of Selected Alkaloids in Degrees Celsius

Aconitine	187 to 188
Atropine	115 to 116
Brucine	178
Colchizine	155
Morphine	230 (decomposition)
Picrotoxin	200
Strychnine	265 to 266

28.11.2.2. General Color Reactions

The use of the general color reactions is practical only for the pure substance of the alkaloids. For the implementation a few crystals of the specimen substance are crushed in a small porcelain dish or in the hollow of a porcelain spot plate with a few drops of reagent. The color reactions and their course are observed and the Table 28.4 shows which alkaloids show the observed reactions. The general color reagents used most frequently are given below.

1. Sulfuric acid concentrated pro analysi.
2. Nitric acid, concentrated pro analysi (D = 1.5 g.cm-3).
3. Froehdes reagent
   0.1 g sodium or 0.5 g ammoniummolybdate are dissolved under mild heating in 10 ml concentrated sulfuric acid. The reagent can be kept for about 10 days when stored in a cool place.
4. Mandelin's reagent
   0.1 g ammoniummetavanadate (free from nitric and chromic acid) is dissolved in finely ground state in 20 ml concentrated sulfuric acid. The reagent can be kept for about 10 days.
5. Erdmann reagent
   20 ml concentrated sulfuric acid are treated with 10 drops of a mixture of 10 drops concentrated nitric acid in 100 ml water.
   Certain color reactions are obtained with this reagent with all phenols. The reagent is freshly prepared each time.
6. Mecke reagent
   0.1 g selenic acid is dissolved in 20 ml concentrated sulfuric acid. The reagent can be kept for about 10 days if stored in a cool place.
7. Marquis reagent
   2 ml 30 percent formaldehyde solution are mixed with 100 ml concentrated sulfuric acid. The reagent can be kept for about a week.
   3 ml of the reagent are treated each time with a trace of the alkaloid.
8. Wasicky reagent
   2 g p-dimethylaminobenzaldehyde are dissolved in 6 ml concentrated sulfuric acid,

Table 28.4. Color Reactions of Selected Alkaloids

	Concentrated sulfuric acid	Concentrated nitric acid	Froehde reagent	Erdmann reagent	Mecke reagent cold	with heating	Wasicky reagent	Vitali reaction	Mandelin reagent
Aconitine	yellow		yellow	bluish-yellow to yellow					brown
Atropine							reddish-violet to red	violet to red	red to yellow
Berberine	olive-green to yellow	red-brown	brownish-green	olive green to yellow brown					
Brucine		blood red to yellow	raspberry red to brownish		yellowish red	lemon yellow			red to yellow
Coniine			colorless to yellowish						
Colchizine	yellow	violet to yellow	violet to yellow	violet to yellow	lemon yellow	yellowish brown			
Curare	brown to red	violet	violet						yellow
Cantharidin					purple-red				
Digitalin (D. verum)	yellow			reddish violet					
Digitonin	red								
Digitoxin	brownish red								
Morphine		reddish yellow	violet red to green		blue to blue green	brown	bright red		red to blueviolet
Nicotine		yellowish to red					reddish brown		
Physostigmine	yellow to green	yellow	light reddish to yellow	light reddish to yellow	brownish to yellow	light brownish red	green		yellowish green
Picrotoxin	orange red								
Scopolamine			deep blue					red	
Solanine	brown, reddish violet on edge		blueviolet to greenish yellow					reddish orange	
Strychnine		yellow							orange red
Veratrine	yellow to orange green to red carmine fluorescence	light yellow	yellow to orange cherry red	yellow to orange green to red to carmine fluorescence			deep green to brown	red violet to orange	yellow to cherry red

to which 0.4 ml water are added. The reagent can be kept for about 1 day. To carry out the reaction a few crystals of the alkaloid are treated with 1 drop of the reagent on a beaker cover and carefully heated on an asbestos plate.

9. Vitali reaction
A few crystals are treated with a few drops of fuming nitric acid and evaporated in the water bath until dry. The residue is treated after cooling with a drop of a solution of calcium hydroxide in absolute ethanol. Characteristic colors appear.

10. Ohkuma reaction [19, 20]
5 to 15 micromoles of the specimen substance are heated with 1 ml of the 2 percent solution of malonic acid in acetic anhydride for 3 to 5 minutes at 100 degrees C. 20 µl of the reaction mixture are placed with a capillary pipette on a thin layer coil coated with silica gel. In the consideration with ultraviolet light (350 nm) we see around the application spot concentric colored rings in a pattern characteristic of the individual tertiary amines. By comparison with color photos of standard experiments it is possible to identify among others the various alkaloids and psychotoxic chemical warfare agents.

29.11.2.3. Group Precipitation Reactions

To carry them out the acidulated alkaloid solution is treated in drops with the precipitation reagent. The formation and appearance of the deposits are observed. The most commonly used precipitation reagents and the deposits obtained with them are described below:

1. Mayer reagent
1.35 g mercury (II) chloride are dissolved in 100 ml 5 percent potassiumiodide solution. The precipitation takes place from hydrochloric or sulfuric acid solution. Amorphous or crystalline precipitates are obtained. Colchicine and solanine are not precipitated; precipitations are obtained with atropine (white, cheeselike), berberine (yellowgreen), brucine (0.02 mg/ml), coniine (amorphous), narcotine, nicotine, morphine, physostigmine, strychnine (0.07 mg/ml) and veratrine.

2. Dragendorff reagent
8 g bismuthsupnitrate are dissolved in 20 ml nitric acid (D = 1.18) and poured into a solution of 27 g potassiumiodide in 40 ml water. It is allowed to stand for 2 to 3 days, removed from the crystallized potassium nitrate and filled up to 100 ml. The reagent is stored in a brown flask. Precipitations are obtained from sulfuric acid solution with the following alkaloids: aconitine (chromium yellow), atropine (powdery, reddish yellow, later canary yellow), berberine (orange red), colchizine, morphine (yellowish red, redissolved when allowed to stand), narcotine, nicotine (0.025 mg/ml), brucine, physostigmine, strychnine (light yellow, later darker) and veratrine (light yellow, later canary yellow).

3. Wagner reagent
5 g iodine are dissolved in 100 ml 10 percent sodium iodide solution. Light to dark brown, mostly amorphous deposits are obtained from hydrochloric acid solution. Atropine, brucine, colchizine, coniine, heroin, narcotine, papaverine (after some time dark red needles) and strychnine give precipitations.

4. Sonnenschein reagent
10 g phosphoromolybdic acid is dissolved in 100 ml water. The reagent gives from hydrochloric, nitric or sulfuric acid solutions amorphous yellow to yellowish brown precipitations, which assume after some time a blue or green coloring. The following alkaloids give deposits: aconitine, brucine, coniine (crystalline deposit), colchizine, narcotine, nicotine (from hydrochloric acid solution: 0.025 mg/ml), physostigmine and veratrine.

Table 28.5. Precipitation Reactions of Selected Alkaloids

	Meyer reagent	Dragendorff reagent	Wagner reagent	Sonnenschein reagent	Scheibler reagent	Gold hydrogen chloride	Platinum hydrogen chloride	Tannic acid, tannin	Picric acid	Picrolonic acid	Marmes reagent
aconitine	+	+		+		+					
apomorphine						+	+	+			
atropine	+	+	+			+	+		+		
quinine	+	+	+			+	+		+		
cocaine						+					
caffeine		+	+	+	+		+				
coniine	+		+	+	+			+		+	+
colchizine		+	+	+		+		+			
curare											
codeine	+	+									+
brucine	+	+	+	+			+	+	+		+
emetine							+		+		
hyoscyamine						+		+			
hydrastine							+		+		
berberine	+	+			+	+	+			+	+
morphine	+	+			+						+
narcotine	+	+	+	+					+		
narceine									+		
nicotine	+	+			+		+		+	+	
papaverine			+				+		+	+	+
physostigmine	+	+		+		+					+
strychnine	+	+	+		+	+	+	+	+	+	
veratrine	+	+		+		+	+	+	+		+

5. Scheibler reagent
10 g phosphorotungstic acid are dissolved in 100 ml water. Flaky, mostly yellow precipitates are obtained with the following alkaloids: berberine, coniine (crystalline), morphine, nicotine (0.01 mg/ml) and strychnine (0.005 mg/ml).

6. Marmes reagent
2 g cadmiumiodide and 4 g potassiumiodide are dissolved in 12 ml water. The reagent precipitates white, mostly amorphous deposits. Berberine (yellow), brucine, coniine (crystalline, morphine, papaverine, physostigmine and veratrine give precipitations.

7. Gold hydrogen chloride
6 to 10 g gold chloride are dissolved in 100 ml diluted hydrochloric acid. White to gold-yellow, mostly crystalline deposits are obtained with the following alkaloids: atropine (recrystallized from hydrochloric acid melting point 138 degrees C), aconitine (amorphous), berberine (orange red), colchizine, cocaine (light yellow), physostigmine, papaverine (melting point 196 degrees C), strychnine (orange) and veratrine (needles from A. melting point 182 degrees C decomposition).

8. Platinum hydrogen chloride
10 g platinum chloride are dissolved in 100 mg dilute hydrochloric acid. From the hydrochloric acid solution with almost all alkaloids bright yellow to orange, crystalline deposits are obtained, whose melting points are characteristic.

9. Picric acid
A cold saturated solution of picric acid is used in water. Amorphous narcotine and veratrine, crystalline brucine (melting point 220 degrees C), papaverine, strychnine and nicotine (melting point 218 degrees C) are precipitated as picrates. Atropine picrate (melting point 175 to 176 degrees C) precipitates from the concentrated solution. The precipitations take place from sulfuric acid solution.

10. Picrolonic Acid
2.64 g picrolonic acid are dissolved in 100 ml ethanol. With most alkaloids yellow to red crystalline deposits are obtained.

11. Tannin
A freshlyprepared 5 percent solution of 5 g tannin (tannic acid) in water is used. Amorphous, white to yellowish deposits are obtained.

12. Godeffroy's reagent
5 g silicotungstic acid are dissolved in 100 ml water. Some alkaloids, for example atropine (0.07 mg/ml) are precipitated with high sensitivity.

28.11.2.4. Special Detection Methods for Some Alkaloids

These detection methods are used after carrying out the general precipitation and color reactions indications of the presence of a certain alkaloid are obtained.

Detection of Aconitine

A few milligrams of the specimen substance are treated in a small porcelain dish with 4 drops 80 percent sulfuric acid and heated for 5 minutes in the water bath. After

adding a few crystals of resorcinol heating is carried out again. A yellowish-brown color reaching the maximum after 20 minutes indicates the presence of aconitine. The detection limit is 0.1 to 0.5 mg.

Detection of Atropine

The color which is first violet and later red obtained in the reaction according to Vitali is characteristic of atropine, since other alkaloids all give immediately a red color.

Detection of Colchizine

About 10 mg of the specimen substance are dissolved in 2 ml 1 to 1 diluted hydrochloric acid and treated with 2 drops of 5 percent iron(III)-chloride solution. When heated in the water bath colchizine gives an olive-green color which becomes even darker after cooling. If the solution is extracted with chloroform it becomes garnet red, and orange with smaller amounts of colchizine. The detection limit is 2 to 5 mg.

Detection of Nicotine

3 ml of the aqueous specimen solution are treated with 0.1 ml 1 percent potassium cyanide solution and 0.5 ml 1 percent monochloramine solution. After 1 minute 1 ml 1 percent barbituric acid solution is added. Nicotine bases give a red to reddish-orange color of the solution. The detection limit is 0.005 mg.

Detection of Picrotoxin

1 to 2 drops of concentrated nitric acid are added to a few milligrams of the specimen substance and it is evaporated until dry on the water bath. The residue is recovered with 2 to 3 drops sulfuric acid. With careful addition of a few drops of 30 percent sodium hydroxide a brick red color indicates the presence of picrotoxin.

Detection of Strychnine

Some crystals of the specimen substance are dissolved in a small porcelain dish in 1 ml concentrated sulfuric acid. A small crystal of potassium dichromate is added and the dish is moved. If strychnine is present we observe when sulfuric acid flows away from the potassium dichromate violet to blue-violet strips starting from the latter. The reaction occurs for 0.001 mg strychnine, it is prevented with nitric acid or nitrates. Aconitine gives a blue to bluish-green color.

28.12. Phytotoxic Substances

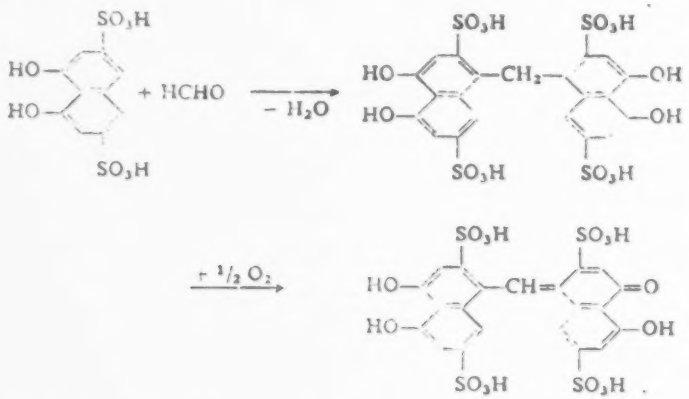
Among the many known phytotoxic compounds the substances of interest in the sector of analysis are the poisons of military significance especially those used by the American Army in South Vietnam for defoliation in jungle warfare and to destroy cultivated plants such as the chlorinated phenoxyacetic acids, the dimethylarsenic acid (cacodylic acid) N-(4-chlorphenyl)-N,N-dimethylurea (monuron), 5-bromo-3-sec-butyl-6-methyluracile (bromocil) and the 4-amino-3,5,6-trichlorpicolinic acid (picloram, tordon).

The use of phytotoxic substances was accomplished mainly with mixtures (agents "white", "orange" and "purple"); to study them it is advantageous to use chromatographic methods.

The detection and determination with chemical methods are naturally carried out more simply in the presence of pure agents. But plant, soil, and water specimens are mainly sent for examination with a very low content of plant poison. A thorough description of the problems arising in the preparation of these sample materials for analysis would go beyond the scope of this book. Insofar as the indications provided below as well as in section 32.7 (Preparation of the Specimens) are not sufficient, one must refer to specialized literature [310,311].

28.12.1. Chlorinated Phenoxyacetic Acids

2,4-dichlorophenoxyacetic acids (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and other herbicides of this group of compounds give off formaldehyde under the effect of concentrated sulfuric acid with heating. Sensitive methods of detection and determination for these phytotoxic compounds are based on their color reactions with different naphtholsulfonic acids. The course of the reaction of formaldehyde with chromotropic acid (1,8-dihydroxynaphthaline-3,6-disulfonic acid) in highly sulfuric acid solution may be explained by the following mechanisms.



28.12.1.1. Qualitative Detection

A few milliliters of the specimen solution or the extract are evaporated carefully until dry in a test tube. A few grains of I-acid (6-amino-1-naphthol-3-sulfonic acid) and 5 ml concentrated sulfuric acid are added to the residue. By careful rotation in the frame it is heated for 5 minutes up to about 170 degrees C. After the cooling a mixture of 2.4 ml water and 0.6 ml acetic acid are added. A blue color indicates the presence of chlorinated phenoxyacetic acids. The detection limit is 0.001 mg. A similar color reaction is obtained with fluoracetic acid. In the presence of esters or ester mixtures of the chlorinated phenoxyacetic acids the latter must be saponified by adding sodium hydroxide in the evaporation.

An enrichment of low concentrations from water samples is possible by extraction of the water acidulated with 1 normal hydrochloric acid with a mixture of ethyl ether and chloroform (1 to 3). The limiting concentration can be reduced through this extraction to less than 5 by 10-5 mg/ml. A quantitative enrichment from water specimens can be

achieved by using basic ion exchanges such as Dowex Amberlite XAD-2 (divinylstyrol-polymer) /304/ or Wofatit SBK. The adsorption takes place from acid solution at pH 2.0; the elution is carried out with acetone or 0.5 M methanol sodium hydroxide. Using a 200 ml water specimen, an exchanger column of dimensions 10 by 30 mm and their elution with 4 by 10 ml solvent (5 ml/minute) the limiting concentration is 2.5 by 10-2 mg, 2,4-D or 2,4,5-T per liter water.

28.12.1.2. Quantitative Determination [309]

The formation of a colored quinoid compound for the colorimetric determination of chlorinated phenoxyacetic acids is caused by the reaction of formaldehyde separated by means of concentrated sulfuric acid with I-acids.

Procedure:

A certain volume of the solvent extract is evaporated until dry in a small vessel on the water bath. The residue is treated with 3 ml of a 0.3 percent solution of I-acid in concentrated sulfuric acid and heated for exactly 5 minutes in the oil bath at 165 degrees C. The cooling to room temperature is carried out quickly and it is transferred into a 25 ml standard flask, containing 15 ml 20 percent acetic acid. It is washed with more acetic acid and filled up. The indigo blue color is photometrized at 580 nm. 10 to 100 µg, 2,4-D or 2,4,5-T can be determined.

Ether and benzol extracts from plants or foodstuffs are purified with aluminum oxide or florisil columns to separate the extracted impurities which were carbonized with concentrated sulfuric acid.

28.12.2. Cacodylic Acid

The detection of the cacodylic acid contained in the "agent blue" in a mixture with a sodium salt is carried out similarly to the general detection of chemical warfare agents containing arsenic (section 28.4.) after oxidative treatment with a common arsenic detection process.

28.12.3. Substituted Urea Herbicides

The detection and photometric determination of the substituted urea herbicides takes place generally by means of acid hydrolisis, diazotation of the aniline derivatives obtained and combination with a dye. Katz [305] gave the following procedure for the determination in water:

100 ml water are extracted with 5 times 50 ml chloroform. The solvent is evaporated and the residue heated for 1 hour with reflux with 15 ml 6 normal hydrochloric acid. After cooling it is diluted with 75 ml water and treated with 1 ml 2 percent sodium nitrite solution. The excess of nitrite is destroyed after 10 minutes by adding 1 ml 10 percent ammonium sulfamate solution. After adding 2 ml of a 1 percent solution of N-(1-naphthyl)ethylenediamine dihydrochloride it is allowed to stand for 15 minutes and the dye obtained is extracted after adding 25 g sodium chloride with 10 ml N-butanol. The organic phase is separated by centrifuging and photometry carried out at 555 nm. Calibration curves were plotted with the pure agents or with the corresponding aniline derivatives, for example chloraniline in monuron. The detection limit is 0.05 mg/l.

28.12.4. Picloram

The herbicide picloram is extracted from soil specimens with 1 normal ammoniumacetate solution. The colorimetric determination /308/ must be carried out with the exclusion of all ultraviolet radiation with a yellow light. After adding 5 times the amount of 7 normal sulfuric acid and the same amount as 0.1 m sodium nitrite solution it is mixed carefully and after 10 minutes the extinction measured at 405 nm.

28.13. Inorganic Poisons

The testing for toxic cations and anions is necessary when examining poison drinking water as well as poison foodstuff and fodder. Some of these inorganic poisons are formed in the destruction processes occurring in the sample material from warfare agents, for example arsenite and arsenate from agents containing arsenic, lead from lead tetraethyl or iron and nickel from carbonyls. The detection of inorganic poisons takes place in the aqueous extract. For field laboratory workers the drop detection processes are particularly desirable with the most specific possible reagents which would allow the omission of the prior separation of cations or anions.

In suitably erected laboratories it is possible to remove the interferences which are partly difficult to exclude by using different methods of isolation, such as the separation process, chromatography and the annular furnace technology. But it is quite possible that one of the two last methods suitably modified should be available also for field analysis in the foreseeable future. Such a prospect is offered for example by the rapid development of the thin layer chromatography method and their fields (compare section 31.3). The further development of the detection processes suitable for field and laboratory may be found in particular in the facilitation of the procedure by the use of stable reagent paper impregnated with reagents. To locate the reaction products at the site of production and increase the visibility reagents which are difficult to dissolve or insoluble in water are used preferably. Insofar as such suitably sensitive reagent papers are available, the advantage of spot methods with regard to saving of time, convenience and the low instrument requirements are obvious.

28.13.1. Toxic Cations

28.13.1.1. General Detection

Part of the cations concerned can be precipitated as sulfides. The unpleasant work with hydrogen sulfide gas is eliminated by using "solid hydrogen sulfide" which means compound which in acid solution give off hydrogen sulfide. Suitable substances are thioacetamide, ammoniumthiocarbaminate, ethyldithiocarbaminate, thiourea, thioformanilide, and various mercaptans.

Procedure:

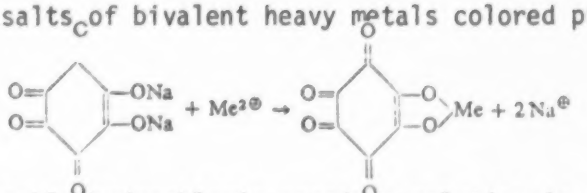
The specimen solution should be 0.25 to 0.5 normal in hydrochloric acid. Thioacetamide is added with the tip of a spatula (20 to 30 mg) to 5 ml and heated for 10 minutes in a boiling water bath. If there is no deposit the substance is treated with an ammonia solution until a pH value of 0.5 and heated once again for 10 minutes.

The following sulfides are deposited: HgS, PbS, PbS2 (black); CdS, As2S3, As2S5 (yellow) and Sb2S3, Sb2S5 (orange).

28.13.1.2. Detection of Barium

Reaction with Sodiumrhodizonate [95]

This reagent gives with salts of bivalent heavy metals colored precipitates.



One drop of neutral or weakly hydrochloric specimen solution is applied on filter paper and a drop of 0.2 percent sodiumrhodizonate solution is added. A reddish-brown color indicates the presence of barium. The limiting concentration is 2 mg/l. Lead, silver, cadmium, thalium, and strontium also form with rhodizonate colored compounds so that the detection is practical only in the absence of these cations.

Precipitation as Sulfate [96]

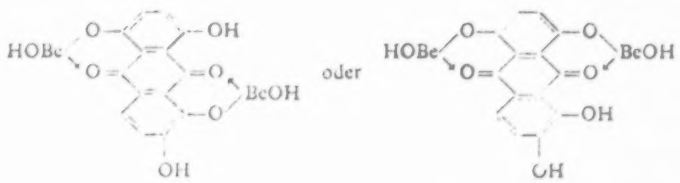
Barium sulfate has besides lead sulfate the characteristic property to include in precipitation the potassium permanganate present in such a way that the latter is no longer attacked by reducing agents.

1 drop of specimen solution is treated with 3 drops of cold saturated potassium permanganate solution and a few drops of dilute sulfuric acid. When hydrogen peroxide, oxalic acid or sulfurous acid are added the color disappears. A violet precipitate depositing indicates the presence of barium. The limiting concentration is 100 mg/l.

28.13.1.3. Detection of Beryllium

Reaction with Quinalizarin [98]

Beryllium salts form in weakly alkaline solution with quinalizarin (1,2,5,8-tetrahydroxyanthraquinone) a bluish-violet colored lacquer to which the following structure is attributed:



Reagent: quinalizarin, 0.05 percent in 2 normal ammonia solution.

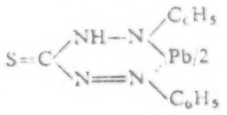
Procedure:

A drop of the specimen solution is treated on a spot plate with a drop of freshly prepared reagent solution. A blue color and in larger quantities a blue deposit

indicates the presence of beryllium. The limiting concentration is 1 mg/l. A similar colored lacquer formed in the presence of magnesium is totally discolored with the addition of saturated bromine water. Iron(III)salts must be masked by adding tartarate.

28.13.1.4. Detection of Lead

With dithizone lead salts give a red internal complex salt:



Since many other cations give complex salts of similar color with dithiazone they must be masked by adding cyanide and tartarate.

Reagent:

Dithiazone, 1 to 2 mg are dissolved in 100 ml carbontetrachloride.

Procedure:

1 drop of the neutral specimen solution is treated in a microtest tube with 1 drop each of 0.05 percent potassiumcyanide and seignette salt solution and then 1 drop of dithiazone solution and agitated thoroughly. The green reagent solution assumes a brick red color in the presence of lead. The limiting concentration is 1 to 2 mg/l.

From neutral or acetic acid solution lead is precipitated with the addition of alkali dichromate as yellow PbCrO4.

28.13.1.5. Detection of Thallium

The disturbances by lead and mercury in the precipitation of thallium as iodide are prevented by the addition of thiosulfate, which allows lead iodide to be dissolved as a complex anion, and using an excess of potassium iodide, which causes the dissolution of mercury into (II)iodide as K2(HgI4).

Procedure:

1 drop of the weakly acid specimen solution is mixed with 1 drop of a 10 percent potassium iodide solution and 2 drops of a 2 percent sodium thiosulfate solution on a beaker cover. A yellow deposit which can be recognized well against a dark background indicates thallium. The limiting concentration is 10 mg/l. If thallium(III) salts are present after iodide precipitation an iodine separation is carried out.

28.13.1.6. Detection of Mercury

Dithizone gives with mercury(II) salts a yellow complex salt.

Reagent:

Dithizone, 0.01 percent solution in chloroform.

Procedure:

1 drop of 10 percent chelaplex III solution, 1 drop of 0.5 normal hydrochloric acid and 2 drops of reagent are added to 1 drop of the specimen solution in a microtest tube. The agitate, while in the presence of mercury the chloroform layer assumes a yellow orange color. The concentration limit is 10 mg/l.

A very simple method of detection can be achieved with a piece of aluminum foil which was blank corroded beforehand with sodium hydroxide. A drop of specimen solution is applied on the washed and dried foil and after 5 minutes removed again with a piece of filter paper. The presence of mercury is indicated by a white "wax" forming after a few minutes on the foil. The concentration limit is 2 mg/l.

28.13.1.7. Detection of Cadmium

The precipitation as yellow cadmium sulfide can be considered as a specific method of detection if the cation which also formed colored sulfides can be masked with cyanide.

Procedure:

1 drop of specimen solution in a microtest tube is treated with 1 drop of concentrated ammonia solution and 1 drop of 20 percent potassium cyanide solution. The solution must be clear and colorless, if not more cyanide is added. 1 drop of a solution is applied on a filter paper and treated with 10 percent sodium sulfide solution. A yellow spot or ring indicates the presence of cadmium. The limiting concentration is 100 mg/l.

28.13.1.8. Detection of Antimony

Antimony (III) salts reduce in acid solution phosphomolybdic acid to molybdium blue /100/. The detection is specific in the absence of tin(II) salts. If work is being carried out with the hydrochloric acid solution of the sulfite precipitate, tin occurs as tetrachloride and does not disturb the detection.

Reagent paper:

Filter paper is soaked with a 5 percent aqueous solution of phosphoromolybdic acid and dried.

Procedure:

1 drop of the hydrochloric acid specimen solution is applied to the reagent paper and the latter held over water vapor. A blue color arising after a few minutes indicates the presence of antimony. The limiting concentration is 1 mg/l.

28.13.2. Toxic Anions

28.13.2.1. Detection of Fluoride

Detection processes for fluoride are described in section 26.1. The glass etching test is very simple to implement [101].

Procedure:

A few grains of potassium dichromate are dissolved in 1 to 1.5 ml concentrated sulfuric acid in a test tube. It is rotated until the wall of the glass is totally degreased and the mixture uniformly wet. A few grains of the solid or 1 drop of the liquid specimen are added and it is heated. With repeated rotation of the glass a nonuniform movement of the sulfuric acid and the formation of nonmoistened areas indicate the presence of fluoride. 0.5 µg fluorine can be detected.

28.13.2.2. Detection of Nitrite

The detection of nitrite takes place with the Griess reagent described in the detection of chloropicrin and which detects still 0.01 µg nitrite.

28.13.2.3. Detection of Arsenite and Arsenate

In general arsenites and arsenates are detected with the Gutzeit test described in the detection of the chemical warfare agents particularly arsenic. In acid solution arsenites and arsenates are reduced, whereas in the heating of the sodium hydroxide solution with metal aluminum only arsenites are reduced to hydrogen arsenide. Arsenates and antimony compounds which form in acid solution with nascent hydrogen SbH_3 remain unchanged. If the arsenic compounds are detected besides antimony, the arsenate must be transformed in acid solution into arsenite with sodium bisulfite; thereafter reduction is carried out in alkaline solution. In the absence of other substances consuming iodine, in a solution containing bicarbonate or acetic acid, the discoloration of the iodine solution or blue iodine-star solution is characteristic of arsenites.

Arsenate gives when treated in acetic acid solution with 1 percent silver nitrate solution, a reddish brown deposit of silver arsenate.

$$AsO_4^{3\ominus} + 3\,Ag^{\oplus} \rightarrow Ag_3AsO_4$$

28.13.2.4. Detection of Selenite

By heating or evaporation with concentrated hydrochloric acid selenic acid and selenates are reduced quantitatively to selenites. Selenites accelerate catalytically the reduction of methylene blue by alkalized sulfides; this effect is used for a sensitive detection [102].

Procedure:

1 drop of specimen solution is placed in the depression of a spot plate; 1 drop of water in the neighboring depression. Thereafter in each cavity 1 drop of 0.2 molar sodium sulfite solution and 1 drop of 0.01 percent methylene blue solution are added. A faster discoloration as compared with the control specimen indicates the presence of selenite in the specimen. The limiting concentration is 1 mg/l.

Check Questions

1. Establish the reaction scheme for the first part of the Schoenemann reaction, that is the conversion of phosphoroganyls with hydrogen peroxide in alkaline solution.

2. Explain the effect of the sequence and type and method of adding the reagents on the sensitivity of the Schoenemann reaction.

3. What fluorescent reaction products are formed in the oxidation of indole by perphosphonic acid?

4. Give other analytically important reactions of organophosphoric chemical warfare agents.

5. What are the possibilities for identification of the organophosphoric warfare agents of the type VX using the chemical and biochemical methods?

6. What is the basis of the principle of the hydrolytic method for the volumetric determination of the fluorophosphororganic warfare agents?

7. What is the course of the reaction between sulfur yperite and thymolphthalein in alkaline solution?

8. Which derivatives of sulfur yperite are suitable for its identification?

9. How is the determination of sesquiyperite possible in mixtures with sulfur yperite?

10. Name some reagents which give with nitrogen yperite a characteristic precipitation?

11. What chemical warfare agents give with 4-(p-nitrobenzyl)-pyridine a colored reaction product? Establish here the general reaction equation.

12. Establish the equation of the reaction for the conversion of hydrogen arsenide with mercury bromide.

13. What products are formed in the reaction of warfare agents containing arsenic with hydrogen sulfide?

14. Why must alpha-lewisite be treated with strong alkaline lye before the detection with the Ilosvay reagent?

15. Name the specific detection process for adamsite.

16. What is the course of the Berlin blue reaction specific for cyanide ions?

17. What is the basis of the formation of the blue color in the reaction of cyanides with copper (II) salts and benzidine?

18. How is the benzoin condensation promoted catalytically with cyanide ions used analytically?

19. Establish the general reaction equation for the course of the reaction of cyanic halides with pyridine and primary aromatic amines.

20. What possibilities of detection are there for BZ?

21. How can CS be detected analytically?

22. Give a reagent generally suitable for the detection of warfare agents with active methyl group and describe the mechanisms of the reaction with chloracetophenone.

23. On what known dyestuff synthesis is the detection of fluoracetate with thiosalicylic acid based?

24. How must the group separation of alkaloids be carried out?

25. Name some color and group precipitation reactions to alkaloids?

26. What compounds are called "solid hydrogen sulfide"?

29. Biochemical Methods

29.1. Advantages of the Use of Biochemical Methods

Enzymes are used increasingly as analytical aids. This development was rendered possible through the enormous advances in the investigation of the mechanism of action and the structure of these biological catalysts. Basically enzymes act in the same way as other catalysts, but for them the catalytical processes are organized in a much higher manner. This may be seen in the high speed constance and low activation energies. Whereas many inorganic catalysts have sufficient activity only at high temperatures, the enzymes show a high activity already at physiological temperatures.

Today enzymes are available to the analyst in a constantly increasing number and with constantly increasing purity for implementing in vitro reactions for analytical evaluation. The advantages of the analytical application of enzymes are the high functional selectivity and sensitivity.

Because of the complicated spatial structure of the enzymes only certain substrates or substrate groups can reach the center of action. Emil Fischer had already established that the enzyme and substrate must fit each other like lock and key. This model representation must naturally be changed a little today since the enzyme is not a rigid matrix, but can change its spatial structure under the effect of the substrate. Through this property of the enzymes it is possible to detect specifically individual substances from mixtures of substances, which allow the omission of long separation processes and reduces the time needed for the analysis.

The catalytic effect of the enzymes and the high number of changes in the separation of the substrate gives the biochemical methods of analysis a sensitivity which lies far above the average analytical scale. By a number of changes we mean the number of substrate molecules which are separated in 1 minute from an enzyme molecule. Thus for example 1 molecule of acetylcholine esterase gives off in 1 minute 1.5 by 10exp7 molecules of acetylcholine. Since on the other hand 1 molecule of an inhibitor can always inhibit completely an enzyme molecule it is possible to derive the extraordinarily high sensitivity of the enzymatic method to determine the organophosphoric inhibitors.

The biochemical methods of analysis have three areas of application:

a) Determination of the activity of the enzymes;

b) Determination of the substrates;

c) Determination of the enzyme inhibitors (inhibiting substances).

Within the framework of the analysis of warfare agents methods for determining the activity of certain enzymes for purposes of diagnosis of poisoning and methods to determine the enzyme inhibiting warfare agents are of particular interest.

The investigations of the physiological effect of warfare agents disclose the fact that in most cases the inhibition of enzyme systems is the cause of the specific physiologic activity. Part of these in vivo effects [2] can also be established in the in vitro

[2] in vivo = literally "in life" which means in the living organism.

Table 29.1. Inhibiting Effect of Chemical Warfare Agents on Enzymes[3]

Enzyme (Source)	Inhibitor	pI50	Substrate
AChE(different)	organophosphoric warfare agents	a few up to 10	acetylcholine-chloride
SChE(different)	organophosphoric warfare agents	a few up to more than 9	butyrylcholine-iodide and others
Aliesterase (horse liver)	sarin	7	3,5-dichlorindo-phenylacetate
ATPase	soman	4	
β- and γ-chymotrypsin	DFP	about 5.3	
Lipase (milk)	DFP	5.3	
Lipase (pancreas)	paraoxon	5.2	
Aliesterase (liver)	DFP	about 6.5	
Esterase (serum)	paraoxon	about 8	
Dehydrogenase (brain)	DFP	about 4	
Phosphatase (kidneys)	DFP	about 3	
Thrombin	DFP	4.5	
Succinatedehydrogenase	soman	3	
Catalase	organophosphoric insecticide		hydrogen peroxide
Urease			urea
Carboxylase			beranzoracnic acid
Pyruvatoxidase (brain)	lewisite		
Succinoxidase	lewisite		
Pyruvatoxidase	sulfur yperite		
Hexokinase (yeast)	sulfur yperite		
Creatinphosphokinase	sulfur yperite		
Pepsin (pig)	sulfur yperite		
Pyrophosphatase (kidney)	sulfur yperite		
Cholinoxidase	sulfur yperite		
Serumpeptidase	sulfur yperite		
Succinyldehydrogenase	sulfur yperite		
Lipase	sulfur yperite		
Xanthinoxidase	sulfur yperite		
Hexokinase	irritants		
Urease			
Pyruvateoxidase			

[3]Established according to the literature data.

Table 29.2. Differentiation of Cholineesterases

	Acetylcholin-Acetylhydrolases	Azylcholin-Azylhydrolases
Synonyms	Acetylcholineesterase (AChE), specific cholineesterase, real cholineesterase, erythrocyte-cholineesterase (EChE), cholineesterase I	Cholineesterase (ChE), non-specific cholineesterase, pseudocholineesterase, serum cholineesterase (SChE), cholineesterase II
occurring mainly	blood (erythrocytes), brain, nerve ends, electric organ of the electric eel (electrophorus electricus), snake venom	blood (serum)
molecular weight	approximately 260,000	different data from 200,000 to 350,000
activity per mole	1.5 by 10exp7	5 by 10exp4 SChE (man)
points of action (number of changes)	6.1 by 10exp5 (electric eel)	
optimum pH[4]	8.0 to 8.5	8.2 5o 8.5
relative activity in the series of homolog o-azyl-cholines	acetyl propionyl butyryl choline	butyryl propionyl acetyl choline
inhibition by substrate excess	inhibition by 3 by 10-3 M acetylcholine	still no inhibition with 10-1 M acetylcholine
causes hydrolysis of:		
tributyrine	--	+
azetylcholine	+	+
acetyl- -methylcholine	+	--
benzoylcholine	--	+

[4]Area of concentration of hydrogen ions in which the enzyme concerned has the maximum activity.

investigations[5] and represents the basis of the highly sensitive methods of detection and determination. The principle of these methods is the comparison of the speeds of separation of the substrate in the enzyme in the presence of the warfare agent to be analyzed (inhibitor) and without it. The sensitivity of the method is determined among other things by the affinity of the enzyme with the inhibitor and the speed of the separation of the substrate. The degree and speed of inhibition of the enzyme can be affected by the choice of certain optimal conditions of the reaction. The use of the optimal substrate affects the state of the appearance of the analytical signal and consequently the sensitivity. Obtaining the optimal substrate is only possible if the mechanism of the catalytical effect of the enzyme is known.

29.2. Inhibition of Cholineesterase with Organophosphoric Compounds

It is apparent from Table 29.1 that the organophosphoric warfare agents inhibit a large number of vital enzymes in the organism. The effect is particularly marked for the cholineesterase while as we know the inhibition of the acetylcholineesterase determines particularly the most important features of the poisoning picture. The mechanism of the catalytical effect and the inhibition of this enzyme which is so important for the nerve function were elucidated to a great extent using the organophosphoric inhibitors as "chemical instruments".

Cholineesterase are all hydrolases (esterases) which give off cholineesters, and which are inhibited by physostigmine in a concentration of 10-5 M. These cholineesterases are subdivided into two groups, whose distinguishing features are indicated in Table 29.2.

The hydrolysis of the substrate catalyzed by the enzyme can be characterized by the Michaelis-Menten equation:

The enzyme and substrate form first a complex (ES) from which the products of the reation come. In the case of hydrolysis of acetylcholine by AChE acetylized enzyme and choline are formed; the acetylized enzyme is very quickly hydrolyzed with formation of acetic acid and enzyme in the original state.

The catalytical effect of the AChE is based on the structure of the enzyme protein. Through the folding of the protein the amino acids from remote areas of the chain come close and form the "active center". This center contains 2 "active points". One of them ("anion point of action") is responsible for fixing the substrate and to a great extent for the specificity of the enzyme; the other "esterase point of action" causes the separation of the substrate.

The following ideas have been put forward on the chemical nature of the points of action and their mechanisms: the carrier of the negative charge in the anion action point is probably the carboxyl anion of an amino dicarbonic acid (aspartic or glutamic acid). The binding of the substrate is accomplished by means of Coulomb forces between this group and the positively charged quarternary group of the acetylcholine. Moreover the van-der-Waals forces on the methyl groups and the methylene group of the substrate as well as weak covalent bonds between the electrophile carbon atom of the carbonyl group and the basic groups of the esterase point of action contribute also to fixing the substrate. In this way the substrate molecule is oriented in such a way that the carbonyl

[5] in vitro = in the test tube. Biochemical reactions which are not carried out in the living organism.

group approaches the esterase point of action at a distance of about 4-5 A from the anion action site and favorable conditions are created for the nucleophile attacks of the activated hydroxyl groups of the esterase action site on the carbonyl group.

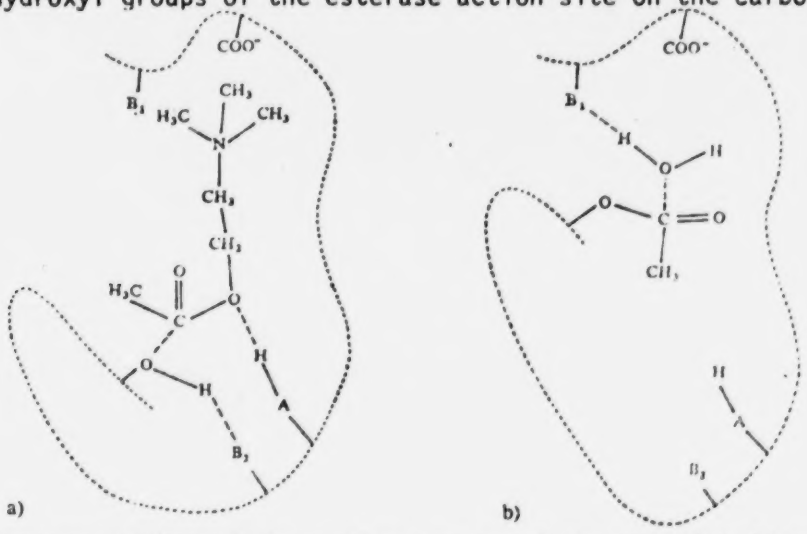
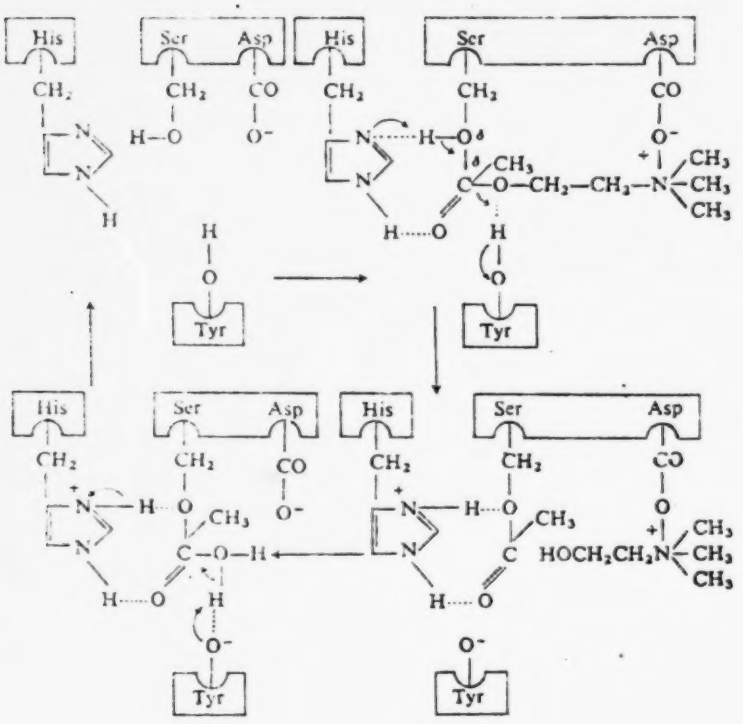


Figure 29.1: Representation of the active center of the acetylcholineesterase according to Krupka [121]. B1 and B2 are the basic groups; AH is the acid group; OH and COO- are serin hydroxy group and anion action site.

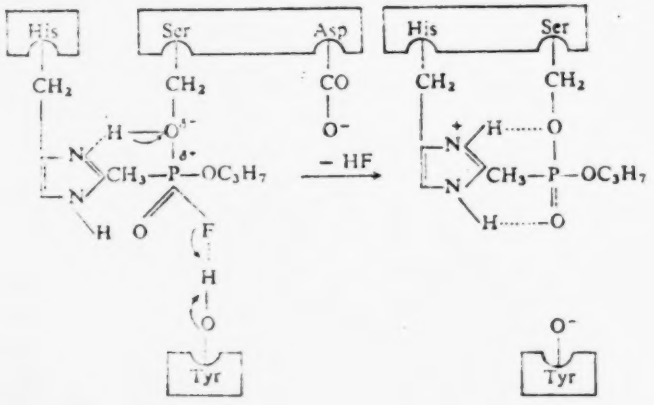
(a) enzyme substrate complex (ES) for acetylcholineesterase
(b) acetylized enzyme (EAc)

In the esterase action site we find an acid and basic acid group whose existence was first derived from the reversible loss of activity on both sides of the pH optimum. In the basic group we have the nucleophile hydroxyl group of serin. Since serin under physiologic conditions can neither catalyze ester hydrolysis nor react with alkylphosphates, it is assumed that an activation takes place through the neighboring amino acid residues. The pKa value of the basic action site was obtained as 5.8 to 7. The imidazol ring in histidine is the only protein group with a pKa (5.6-7.1) in this range. It is therefore assumed that the doubly bound nitrogen atom of imidazol takes a proton from the serin hydroxyl group and the anion formed attacks the substrate in a nucleophile manner. The acetylzed serin formed is brought by a change of conformation into the neighborhood of a second imidazol group, which takes a proton from water and thus causes the hydrolysis of the acetylzed serin. The acid active group in which we are dealing presumably with the hydroxyl group of tyrosine forms first a hydrogen bridge to the alcohol oxygen and causes in the next stage the separation of the choline residue. A simple scheme for the described mechanism of substrate separation was given by Krupka [121].

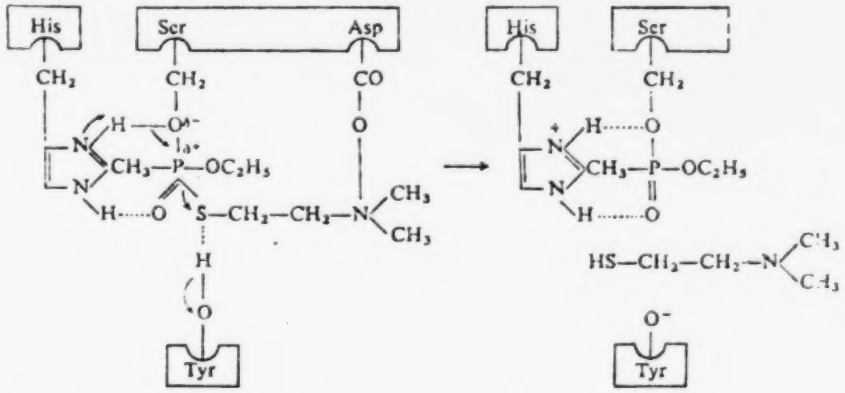
It should be added that these ideas of the enzyme catalyzed hydrolysis of choline ester are not final and for example a further scheme was developed for the mechanism [295] in which the acid active group causes first the splitting of the choline as proton donor and then in the anion form acts as proton acceptor causing the hydrolysis of the acetylized serin.



The irreversible inhibition of AChE through the organophosphoric warfare agent is based on a phosphorylation which corresponds in principle to the acetylization of the enzyme in the substrate hydrolysis. But unlike the acetylized enzyme the phosphorylized enzyme under physiological conditions is hydrolyzed only extremely slowly. Only with a stronger nucleophile reagent (reactivators) the phosphoric acid ester is separated more quickly from the enzyme. The phosphorylation of AChE through sarin can be described as follows.



The extraordinarily high inhibiting effect of phosphorylcholine and phosphorylthiocholine compounds ("Tammeline esters") shows that the affinity of an inhibitor to an enzyme and thus its inhibiting effect just like for the specific substrate can be increased by introducing a cation group taking into account the distance between anion and esterase active site (2 CH2 groups).



The phosphorylized enzyme is now transformed with a secondary reaction taking place with different speeds into a stage which can no longer be reactivated ("aging"). Since in an AChE aged and inhibited by sarin isopropyl alcohol was detected, this aging is due most probably to a dealkylation. In the case of the AChE phosphorylized by soman this reaction is completed already after 2 to 5 minutes.

The organophosphoric inhibitors are competitive inhibitors and as is apparent from the previous considerations interact with at least one of the same active sites of the enzyme as the substrate. The result is that in the presence of substrates the speed of the reaction of the inhibitor with the enzyme decreases with the increasing concentration of substrate. Therefore it is necessary in determinations of the inhibitor first to incubate the enzyme with the inhibitor and then to add the substrate to obtain the residual activity. Another factor very important for analytical methods is the different speed of the reaction of the individual organophosphoric inhibitors with the enzyme which must be taken into consideration when choosing the incubation time. Dialkylaminoalkylfluorophosphonates react very quickly with the enzyme, O-alkyl-methylfluorphosphonate (sarin, soman) only a little slower, the O-alkyl-S-(N,N-dialkylaminoalkyl)-alkylthiolphosphate and phosphonates (V-substances) on the other hand are much slower. The relations between the resistance to hydrolysis of the compounds and the speed of the inhibiting reaction are apparent. This is understandable since the catalyzed hydrolysis of the organophosphoric compound can be considered as model reaction for the phosphorylation of the enzyme. Instead of the hydroxide ion in the SN2 reaction the nucleophile center appears on the enzyme. For the nucleophile attack on the enzyme on the atom of phosphorus the differences in the charge distribution between the atom of phosphorus and the different neighboring atoms (F,S,O) act in the same way as in the hydrolysis on the reaction compatibility with the nucleophile reagent. Since the reaction of the organophosphoric inhibitors with the enzyme takes place much more quickly than with the hydroxide ion, it is possible to assume for the secondary reaction favorable fixing of the active sites of the enzyme.

The above considerations on the substrate separation and inhibition of the AChE can be transferred in many respects to the nonspecific cholineesterases (ChE). Of this group of esterases highly purified preparations have not yet been produced as for the AChE, therefore the properties of the structure are not known in such detail. For example the existence of an anion active site in the ChE is disputed, and one tends to the opinion that the fixing of the substrate in the ChE is accomplished mainly by the van-der-Waals forces. The differences existing undoubtedly in the structure of the active centers are apparent also from the different substrate specificity (see Table 29.2) and from the different inhibition capacity by selective inhibitors. Thus O-ethyl-S-(N,N-dimethylaminoethyl)-methylthiophosphonate is a selective inhibitor of AChE, whereas O,O-diethyl-S-(N,N-dimethylaminoethyl)-thiophosphate inhibits the ChE more strongly [122].

More recent investigations [165] with selected organophosphoric inhibitors show that in the inhibition process of choline esterases the hydrophobicsorption in the hydrophobic regions in the active centers of the enzyme play an important and sometimes a decisive role. Through the interaction of these hydrophobic regions with the alkyl radicals of the inhibitors for example it is possible to explain also the extraordinarily high anticholineesterase activity of pinacol esters (soman).since it was established that both in the AChE and in the ChE in the neighborhood of the anion active site there must be a hydrophobic region which is the most complementary for radicals with highly branched butyl groups. Moreover it was established that immediately around the anion active sites a hydropholic region must exist to which greater importance must be assigned for the substrate fixing in the ChE than in the AChE. In the neighborhood of the esterase active site for the AChE another hydrophobic region is suspected and two more for the ChE. Probably these differences determine significantly the different properties of both cholineesterases.

29.2.1. Determination of the Inhibiting Effect

The characterization of the inhibiting effect is carried out by determining the concentration of inhibitor which inhibits the enzyme up to 50 percent under certain conditions. This concentration is designated as I50; in most cases it is indicated in the form of its negative logarithms as pI50.

$$pI50 = -\log I50$$

These values are typical constants of the substances (compare Table 29.3.). The assumption for the comparability of the values is their determination under exactly defined conditions, that is under certain temperature, time of incubation and reaction, concentration of enzyme and substrate and definite pH values. For example in the electrometric method, the enzyme is incubated for 30 minutes at 25 degrees C; the initial pH value is 8.0 and the reaction is allowed to proceed for 60 minutes with a substrate concentration of 7.3 by 10-3 moles ACh/l /123/. To obtain the I50 the activity is measured with different inhibitor concentrations. The diagram is prepared in which the measured ratio of the inhibited enzyme to the noninhibited enzyme (in percentage of inhibition) is plotted against the negative logarithm of the inhibitor concentration. An example of this procedure may be found in Figuare 29.1. The informative content of the pI50 values is limited by different secondary reactions which take place as a function of the properties of the inhibitor and the enzyme and the experimental conditions. Such secondary reactions which compete with the enzyme inhibition are the spontaneous hydrolysis, the hydrolysis of the inhibitor through the phosphorylphosphatases contained in the enzyme, the adsorption

on the wall of the glass containers with very dilute solution and the reaction with other active groups of the proteins present, moreover with weak inhibitors the inhibition and reactivation can take place simultaneously.

Table 29.3: pI50 Values and Speed Constants of the Second Order for the Inhibition of Cholineesterases and the Alkaline Hydrolysis

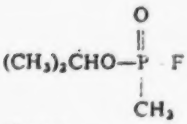
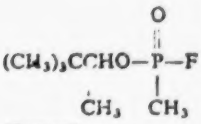
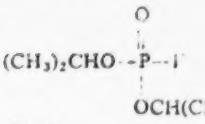
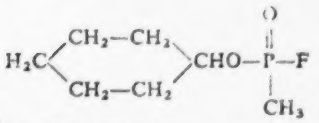
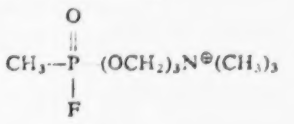
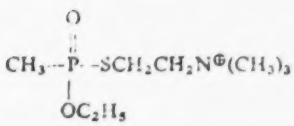
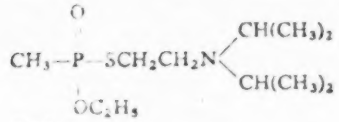
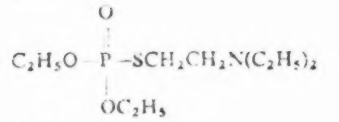
Inhibitor	pI_{50}		k_2 bei 25°C $l \cdot mol^{-1} \cdot min^{-1}$		k_2 OH^- bei 25 °C $l \cdot mol^{-1} \cdot min^{-1}$
	AChE	BuChE	AChE	BuChE	
 (Sarin)	8,9	8,4	$1,4 \cdot 10^7$	$1,7 \cdot 10^7$	1560
 (Soman)	9,2	8,6	$6 \cdot 10^7$	$2,1 \cdot 10^7$	83,3[3])
 (DFP)	6,6	7,8	$4,8 \cdot 10^4$	$1,5 \cdot 10^7$	49,8
 (Cyclosarin)	10,1[1])		$3,3 \cdot 10^5$	$1,6 \cdot 10^7$	
	11,0	8,4		$1,1 \cdot 10^7$ [2])	18300
	9,1	7,9		$1,2 \cdot 10^5$	12

Table 29.3. (continued)

Inhibitor	pI_{50} AChE	pI_{50} BuChE	k_2 bei 25°C $l \cdot mol^{-1} \cdot min^{-1}$ AChE	k_2 bei 25°C $l \cdot mol^{-1} \cdot min^{-1}$ BuChE	k_2 OH^- bei 25°C $l \cdot mol^{-1} \cdot min^{-1}$
 (VX)				$2,3 \cdot 10^6$	1,2[3])
 (Amiton)	7,9[4])	8,3	$2,5 \cdot 10^6$	$3 \cdot 10^7$	0,8

1) cattle erythrocyteesterase.
2) in the presence of substrate in a concentration of 1.87 by 10-2 mole/l.
3) in seawater.
4) at 37.5 degrees C.
5) at 20 degrees C.

Some authors consider the indication of the bimolecular speed constant k2 of the reaction between inhibitor and enzyme

$$EH + P \,.\, X \rightarrow E \,.\, P + HX$$

as specific and particularly for slow reacting inhibitors as depending on the properties of the substance (Table 29.3. gives some of the values known from the literature for k2), but the I50- or pI50- values can be considered as more informative with regard to the toxicity of the inhibitors.

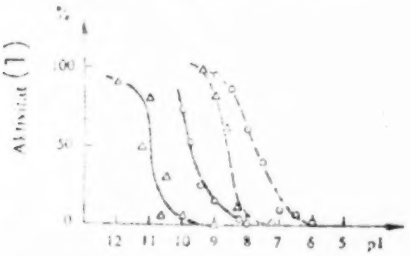


Figure 29.2: Diagrams to obtain the pI50- value
_____AChE; -------ChE; △ methylfluorophosphorylcholine; O methylethoxyphosphorylcholine (V-substance) (taken from Tammelin, L.E.; Ark. Kem. 12 (1958),S.287).
(1) activity

This is proved by the fact that the V-substances reacting slowly with the enzyme have approximately an equal toxicity as the very quickly reacting methylfluorophosphorylcholine.

Between the I50 value and the bimolecular speed constants k2 the following relation exists.

$$k2 = \frac{C.695}{I50 \,.\, t}$$

29.2.2. Determination of the Cholineesterase Activity

Whereas the purpose of the AChE, the fast disintegration of the acetylcholine formed in the transmission of nerve pulses is fixed, the physiological function of the ChE has not yet been clarified completely. In case of poisoning with organophosphoric compounds a decrease of the ChE activity can be established but one which is not always proportional to the seriousness of the clinical symptoms. Thus a decrease of the activity by 85 percent of the initial level was established without the occurrence of symptoms; on the other hand in poisonings by inhalation strong symptoms can appear without considerable change in the activity. But in general the determination of the activity of the ChE in the serum offers a satisfactory possibility of diagnosing poisoning with organophosphoryls. A decrease to 40 percent of the normal value can be evaluated as a beginning of damage, if other factors which reduce the activity, such as hepatitis, anemia or various infectious diseases can be excluded. A more reliable, but less sensitive indicator of the poisoning with organophosphoryls is the determination of the AChE activity. It is therefore less suitable for the prophylactic examination of people working with organophosphoric compounds, the more so as the ChE activity is more easily measured because of the greater selection of substrates.

To determine the activity of the AChE in the blood of men and mammals the red blood corpuscles (erythrocytes) were hemolized; the ChE is determined in serum. In case of determination in full blood a differentiation can be achieved by choosing specific substrates, such as acetyl-beta-methylcholines for AChE and butyrylcholine for ChE, or by using certain substrate concentrations. The last method is based on the already known inhibition of the ChE by higher substrate concentrations. Thus for a concentration of 10-3M acetylchloline the AChE is recorded mainly, for 10-1M the ChE. Naturally each time the other enzyme is included to a certain extent (about 1/5).

The determination takes place either by obtaining the speed of the enzymatic substrate separation reaction ("kinetic method") or by determining the final products or the nonconverted substrate ("final value method").

To characterize the enzyme activity according to the method of determination various mass numbers are used. For the classical manometric method the amount of carbonic acid released is the measure of the activity. Ammon [12] defines as "cholineesterase unit" the amount of enzyme which in 1 hour at 37 degrees C and pH 7.4 can separate 10-6M acetylcholine. This amount of acetylcholine corresponds also to 10-6 M carbonic acid (=22.4 mm3). To evaluate the activity obtained in the blood of a control subject the knowledge of the normal values and their spread is important. For a test with 0.05 ml serum for the manometric maintaining the above-mentioned conditions in normal value of 7 to 10 cholineesterase units is indicated [12]. In the colorimetric method by determination of the nonconverted acetylcholine [13] the cholineesterase unit taken is the number of micromols of acetylcholine which are hydrolized by 1 ml serum in 1 hour at 37 degrees C. This corresponds to 20 times the Ammon unit. The normal value indicated is 130 to 310 units.

In the electrometric method the cholineesterase activity is expressed in the drop of pH after 60 minutes reaction time. The normal value at 25 degrees C and using 0.2 ml serum is a Δ pH value of 0.70 to 1.05 [14].

To determine the cholineesterase activity a large number of methods have been established. The most reliable values are given by the methods based on the determination of the product produced, in which a linear relation exists between the enzyme activity and the measured value. Although it is complicated to implement, in this respect the manometric method has not yet been surpassed. The electrometric methods are simple to implement and give very exact values particularly when using an autotitrator by keeping constant the pH value affecting the enzyme activity. We give below a survey of the different methods of determining the activity. For a detailed description the manometric and electrometric methods were selected for the above-mentioned reasons.

I. Determination of the acid formed in the separation of the carboxylcholines.

1. Manometric methods [125, 126, 127]

They are based on the measurement of the CO2 volume which is released by the acetic acid formed in the separation of acetylcholine from the bicarbonate buffer. It is established with the known Warburg equipment. A new warburg vessel suitable particularly for the measurement of inhibition of ChE has been described by Adie [131].

2. Titrimetric method

The acid released is titrated after adding a suitable indicator (bromothymol blue, phenol red) or by control with a pH measurement equipment in 5 minute intervals for a period of 1 hour with sodium hydroxide every time the same pH value [132].

The titration with an autotitrator through which the pH value is kept automatically constant so that the enzyme activity undergoes no change during the measurement is very advantageous [129].

3. Electrometric method (ΔpH methods)

For these methods the change in the pH caused by the acid after a certain period is measured with a pH measuring equipment. A special buffer developed by Michel [130] with an initial pH value of 8.0 is used, whose buffer properties guarantee a linear relation between the enzyme activity and the variation of the pH. Another advantage of the method lies in the possibility of studying parallelly a very large number of specimens. The methods whose results appear as a pH value can be calibrated by adding standard acid to the buffer enzyme mixture per micromol separated acetylcholine. The drop of the pH value is measured for certain amounts of acid, and on the basis of these values a calibration curve is established from which it is possible to obtain the amount of substrate separated.

4. Colorimetric methods with pH indicator

The enzyme specimen is treated with substrate and a suitable indicator, therafter we determine the time up to the identity of the color with that of a standard solution. The pH value of the standard solution produced by adding suitable amounts of acid is conveniently in the area of the most sensitive change in color of the indicator, for example for bromothymol blue at pH 6.8 to 7.2. The measurement of time can be carried out by visual colorimetric or photometric determination of the identity of color. Other suitable indicators are phenol red and M-nitrophenol.

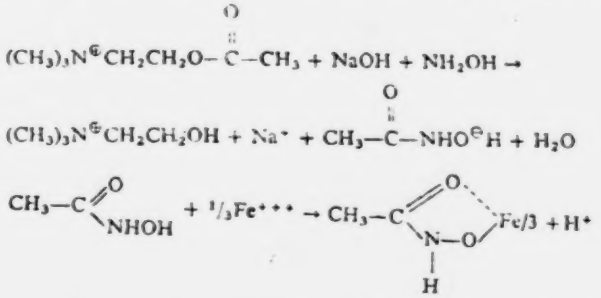
5. Methods with substrate indicator papers

These papers developed by Herzfeld and Stumpf [133] by modification of the indicator method are used for the clinical rapid determination of AChE and ChE and are produced commercially with acetylcholine as substrate and bromothymol blue under the designation "acholest" [134] and "biophan C" [135]. The paper described by Matousek and Cerman [136] with butyrylcholine as substrate gives faster indications and is specific for ChE. After incubation of the papers on an object carrier with a drop of serum (0.05 ml) the time taken for the color to be identical to a standard (pH 6.47) is measured.

In a patent of the Merck Company [166] a paper impregnated with an alcoholic solution of 15 percent acetylcholinechloride and 0.1 percent indicator mixture (phenol red and naphtholphthalein 1:1) is described. After the addition in drops of the serum (0.04 ml per cm2) within 6 to 8 minutes in amount of substrate differing as a function of the ChE activity is separated, and in the pH range of 6 to 8 the different shades of the indicator are adjusted which can be compared with a color scale.

II. Determination of the nonseparated acetylcholines

After 30 or 60 minutes reaction time by adding alkaline hydroxylaminehydrochloride solution the excess acetylcholine into hydroxamiacetic acid, which forms at pH 1.0 to 1.4 with iron(III)-chloride a reddishbrown internal complex salt with an absorption maximum at 520 nm.



The method established originally by Hestrin [137] gives especially according to the procedure described by Pilz [138] very reliable values and is frequently used. The determination of the excess acetylcholines can also be carried out according to the principle of the Schoenemann reaction (compare section 28.1) [139].

III. Determination of the efficient products of carboxylthiocholines

Carboxylthiocholines are separated more quickly than cholineesters and because of the manifold possibilities of determining the efficient product thiocholine they are used extensively. In the simplest case the removal of the substrate is determined by UV spectral photometric measurement (maxima of the acetylthiocholines at 226 or butyryl-cholines at 250 nm).

1. Colorimetric determination of thiocholines

With sodium nitroprusside thiocholine produces a color (λ max 520 nm). Another photometric method is based on the measurement of the yellow color which arises in the reaction of thiocholine with 5,5-dithio-bis-(2-nitrobenzoic acid) [40]. This method is very convenient in its procedure and requires only a short time.

2. Electrochemical determination

A modern method [42] is based on the depolarisation of a platinum electrode through the thiocholine which is oxidized on the anode into diosulfide. The work is carried out in the tris-buffer at pH 7.4 with substrate concentrations of 2.10-3 M butyryl-thiocholine iodide for ChE and the same concentration of acetylthiocholineiodide for AChE. One calomel and two platinum electrodes are dipped into the substrate buffer solution. On the platinum electrodes a constant current of 25 μA is applied. After adding the enzyme solution, the change of voltage between the platinum electrode and the kalomel electrode is plotted on an automatic recording instrument against the time. From the curve obtained the slope $\Delta E/\Delta t$ (in millivolts per second) is determined and from the calibration curve which was recorded with known enzyme activities it is possible to obtain the activity of the specimen enzyme.

The method is applicable to determine the enzyme activities and the concentration of substrates and inhibitors. The presence of the iodide ion in the solution to form the initial potential ($2J^{\ominus} \rightarrow J2 + 2e^-$) is indispensable and is assured by the use of iodide as acetylthiocholine.

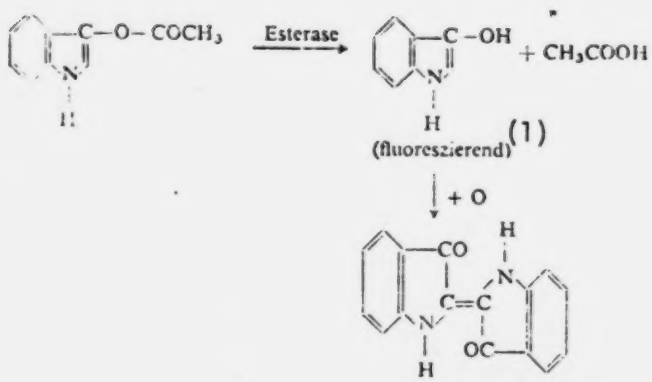
Since acetylthiocholine is polarographically inactive, while thiocholine on the other hand shows an anodic stage typical for -SH groups, for the growth of the anodic stage per unity of time we may derive a measure of the activity of the cholineesterase [43]. The polarographic determination is less time consuming.

The determination of the activity by means of a liquid membrane electrode selective for acetylcholine ions is very elegant [67]. The ratio of selectivity of the electrodes against choline is 15 to 1. The potential measured against a kalomel shows the linearity of the curve E = f (lg a) up to 10-5 M acetylcholine. The time up to the change of the concentration of the substrate from 1.95 by 10-3 M to 1.85 by 10-3 M is used for the calculation. The unit used is the amount of enzyme which hydrolyzes at pH 8.0 within 1 minute 1 by 10-5 mol substrate.

IV. Determination with chromogenic and fluorogenic substrates.[6]

The use of substrates which in the separation of the carboxyl group a colored or fluorescent product is very advantageous for the histochemical location and for the colorimetric and fluorimetric determination of the activity of esterases. Some of these substrates are separated specifically from certain esterases. For histochemical studies the most commonly used are indoxylacetate and a few halogen substituted derivatives of indoxylacetate, mainly the 5-bromo-4-chloroindoxyl. The evaluation or measurement is carried out either through the fluorescnet indoxyl [57] or colorimetrically after oxidation to indigo or indigo derivatives [44].

[6] substrate which gives for an enzymatic separation a colored or fluorescent product.



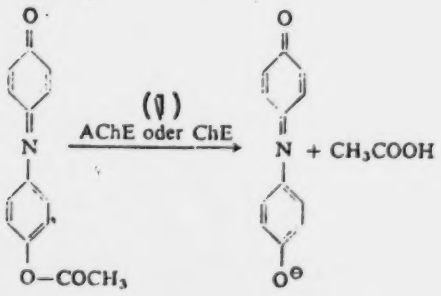
Key: 1) fluorescent

Guilbault [168] recommended instead of indoxylacetate the N-methylindoxylacetate which is separated more quickly and whose fluorescent efficient product N-methyl-indoxyl has a greater stability against the oxidation of air than the nonfluorescent indigo green, which makes the measurement of fluorescence more exact.

The separation of resorufinacetate by ChE at pH 7.4, by phosphatase and α and β chymotrypsin gives the highly fluorescent resorufin of which 10-8 mol can still be detected fluorometrically [158].

The fluorescence of the naphthol formed in the enzymatic separation of α and β-naphthylacetate is also used for the very sensitive measurement of enzyme activities. Likewise in the hydrolysis of methylumbelliferonacetate by ChE in phosphate buffer of pH 8.0 the highly fluorescent methylumbelliferon is obtained [171].

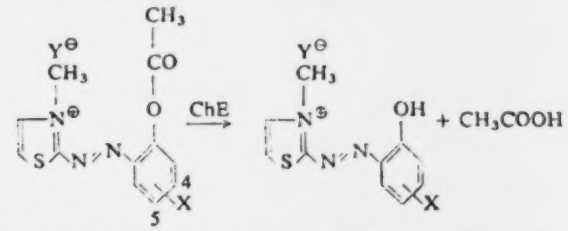
Some methods are based on the measurement of the separation of indophenylacetate at pH 8.0 [145]; the blue color of the indophenol produced is measured at 625 nm. The method gives exact and reproducible values at 25 to 150 cholineesterase units according to Ammon.



Key: (1) or

The drawback of this substrate is that the phenolate ion formed is dissociated completely only for pH values over 9.5 and thus in the colorimetry the maximum sensitivity cannot be achieved for the pH value of 8.0 optimum for the substrate separation. On the other hand the use of 2,6-dichloroindophenylacetate is advantageous because in this case the phenolate ion is dissociated totally already at pH 6.5 and the separation of this substrate moreover takes place at a speed about

three times higher [169]. The measurement of the color takes place at 610 nm. Other very suitable chromogenic substrates are some of the 1-(2-thiazolylazo)-2-acetoxybenzol derivatives [170]:



X = 5-CH3; Y=(CH3)2SO4 yellow → blue (585 nm)
X = 4-N(CH3)2; Y = J blue → red (484 nm)

The hydrolysis of substrates of this type takes place with optimal speed in the phosphate buffer at pH 7.0.

29.2.2.1. Determination of the Cholineesterase Activity in the Serum with the Warburg Apparatus [125]

Reagents:

A. Sodiumbicarbonate/Ringer solution

The following are mixed: 30 ml 1.26 percent NaHCO3 solution, 100 ml 0.9 percent NaCl solution, 2 ml 1.2 percent KCL solution and 2 ml 1.76 percent CaCl2 by 6 H2O solution.

B. Substrate solution

50 ml acetylcholinechloride are dissolved in 10 ml solution A (prepared fresh every day!)

Procedure:

The work is carried out with a measurement volume of 2 ml; the measurement temperature is 37 degrees C; the gas phase contains 5 volume percent CO 2 in nitrogen. In the main chamber of the Warburg vessel 1.5 ml substrate solution are placed, in the attachment 0.5 ml of the serum diluted 1 to 50 with solution A. After 10 minutes tempering the manometer cocks are closed and the serum is dipped into the main chamber. At intervals of each time 10 minutes the manometer readings are taken for 1 hour and the results are noted. For each determination a control value is taken to measure the spontaneous hydrolysis of the substrate, containing instead of serum solution A.

Calculation:

The pressure increase read (in millimeters Brodie solution) is corrected each time by the amount of the control value; the corrected values are multiplied by the vessel constant. The millimeters of carbon dioxide are plotted against the time; after graphic averaging the 60 minute value is divided by 22.4 µl and we obtain the micromol of acetic

acid (= micromols of the acetylcholine separated). Since 0.01 ml serum was introduced, to calculate in cholineesterase units one must multiply by 100. The normal value is 150 ro 200 units.

Remark:

One may obtain further information in the relevant literature on the general procedure with Warburg equipment which needs some practice [164].

29.2.2.2. Determination of Cholineesterase Activity According to the ΔpH Method [124]

Reagents:

A. Buffer solution (Michel buffer)

1.2371 g sodiumveronal[7] (0.006 m), 0.1361 g potassiumdihydrogenphosphate (0.001 m) and 17.535 g sodiumchloride (0.3 m) are dissolved in 900 ml water free from carbon dioxide and treated with 10 ml 0.1 normal hydrochloric acid. After filling to 1 l the pH value is measured at 25 degrees C and should be about 8.00. If necessary it is adjusted exactly with 0.1 normal hydrochloric acid. Two drops of toluene are added for preservation.

B. Substrate

3 g acetylcholinebromide are dissolved in 100 ml water and treated with two drops toluene. The solution is kept in the refrigerator.

Procedure:

10 ml distilled water, 0.2 ml serum and 10 ml buffer (A) are pipeted into a 50 ml Erlenmeyer flask. This mixture is tempered for 10 minutes in the thermostat at 25 degrees C and then we determine with a glass electrode measurement chain and a pH measurement device the pH value exactly within 0.01 pH. Then 2 ml substrate (B) are added, we mix quickly and note the time. After exactly 60 minutes the pH value is measured once again. When several specimens are processed, we work with short time intervals; the electrode is then dipped again each time 30 to 60 s before the measurement to temper the system.

Calculation:

pH1 - initial pH value
pH2 - final pH value
t1 - time of added substrate
t2 - time of reading the pH2
b - correction factor for spontaneous hydrolysis in accordance with pH2
F - correction factor of the deviations of the ΔpH/h

[7] sodium diethylbarbiturate acid.

Table 29.4. Correction Factors

pH_2	b	F
7,9	0,09	0,98
7,8	0,07	1,0
7,7	0,06	1,01
7,6	0,05	1,02
7,5	0,04	1,02
7,4	0,03	1,01
7,3	0,02	1,01
7,2	0,02	1,0
7,1	0,02	1,0
7,0	0,01	1,0
6,8	0,01	1,0
6,6	0,01	1,01
6,4	0,01	1,02
6,2	0,01	1,04
6,0	0,01	1,09

Remarks:

If the method for determining the activity of dry sera and enriched sera is used care must be taken that about 12 to 13 mg protein are contained in the sediment; this is needed to control the protein component for the buffer capacity of the system and therefore the comparability of the values. The method can be used to determine the I50 values and the inhibitor concentrations [96]. For this last purpose the serum buffer mixture is incubated for 30 minutes with the inhibitor solution before adding the substrate. A control experiment without an inhibitor is started parallelly. From the pH values measured after the reaction period the inhibition is calculated by the following formula:

$$\frac{(pH1 - pH2K) - (pH1 - pH2P)}{(pH1 - pH2K)} .100 = \text{percentage inhibition}$$

pH1 - initial pH value
pH2K - final pH value of control
pH2P - final pH value of the specimen.

The inhibitor concentration corresponding to the calculated inhibition is taken from a calibration curve established with known inhibitor concentrations. The work is carried out with standardized solutions of dry serum.

29.2.2.3. Photometric Determination of the Cholineesterase Activity [141]

This micromethod which can be carried out quickly is based on the reaction of the thiocholine formed in the enzymatic separation of the acetylthiocholine with 5,5-dithio-bis-(2-nitrobenzoic acid)(DTNB). The mechanism of this thiol color reaction is described in section 28.1.1.5.

Reagents:

A. DTNB buffer solution

25 mg DTNB, 1.66 g sodiumchloride, 62.5 ml 0.2 molar trisbuffer solution (=tris /hydroxymethyl/aminomethane) and 100 ml 0.1 normal hydrochloric acid are placed in a 250 ml measuring vessel and filled up with distilled water. The pH value of this buffer solution is 7.4 at 37 degrees C; it is stable for two weeks when kept in the refrigerator.

B. Substrate solution

0.52 g acetylthiocholineiodide are dissolved in 100 ml water (0.018 molar).

C. Quinidinesulfate, 0.5 percent aqueous solution or 0.5 percent DFP solution

Procedure:

Two test tubes of which one is used for the specimen, the other for the control tests are filled with 4 ml A and tempered for 5 minutes in water bath at 37 degrees C. To this end 0.02 ml is added for each and thereafter in the control experiment 1 ml C. 0.5 ml B is added to each of the two tubes, and mixed. Exactly 3 minutes after adding B the reaction in the specimen is stopped by adding 1 ml C and the extinction of the specimen and control determined immediately afterwards by photometric measurement at 412 nm.

Evaluation:

The measured difference of extinction of sample and control experiment is converted to the micromol of separated acetylthiocholine per 3 minutes and 1 ml serum. To this end a factor is used obtained from a calibration curve which was plotted with glutathion or another substance with known content of SH groups.

The normal values found were 7.8 to 16.6 µmol SH per 3 minutes and 1 ml for man and 5.8 to 13.8 for women.

29.2.3. Determination of Cholineesterase Inhibitors

All the methods mentioned for determining the activity are suitable when modified accordirgly for the sensitive determination of the inhibitors, except for the manometric determination whose sensitivity is too low for trace analyses.

The difference in the procedure consists in the use of enzyme solutions of known content which are incubated for a certain time with the inhibitor. Thereafter the substrate is added and the residual activity of the enzyme determined by the usual method. The incubation time necessary to achieve a sufficient sensitivity depends mainly on the speed of the reaction of the inhibitor with the enzyme. The reaction of phosphorylthiocholines with the enzyme can be considered as complete after 2 hours. The advantage here is that these components are exposed only to a very slight extent to hydrolysis and hardly any secondary reactions. On the contrary for the methylfluorophosphorylcholines which react fast with the enzyme very short incubation times are used. For the fluorophosphonates of the sarin type in general 10 minutes of incubation are sufficient for sensitive recording, for VX and the insecticide organophosphates it is proper to incubate for 30 to 60 minutes.

Since the inhibition depends to an equal extent on the pH value as the substrate separation, it is necessary to maintain the optimum pH range for the corresponding enzyme during the incubation with the inhibitor. For VX and similar compounds which have a tertiary amino group in the molecule care should be taken that the inhibition effect depends on the degree of ionization of the compound. For pH values above 8.5 the component of nonionized compound increases and the inhibition decreases. Anotehr prerequisite for reproducible results is the use of enzyme preparations with standardized activity. The one used most commonly is lyophilized horse blood serum. Insofar as it is not available as a commercial product, it can be produced on the laboratory scale by lyophilization (freeze drying) of liquid serum by relatively simple means.

To this end the liquid serum is frozen in a glass dish and placed in a vacuum exsiccator; the latter is connected through glass tubes with the largest possible cross-section through a cooling trap with an oil vacuum pump. According to the vaccum, which must be at least 10-2 torr, the serum is dried completely after a few hours or days. Before the use for analytical purpose, the activity is determined by means of a standard method such as the electrometric pH method. To record the calibration curves and carry out the determinations then each time enzyme solutions of the same activity are prepared.

It is advantageous to use purified enzyme preparation from which a part of the protein ballast was removed by fractionated precipitation with ammoniumsulfate for different pH values [132, 147, 148]. The dry substances obtained after centrifuging of the deposits and after dialysis and lyophilization then have as compared with the normal serum an increased activity according to the degree of purification, lower buffer effect and lower tendency to denaturation.

The initial materials for AChE preparation include primarily mammal erythrocytes, but the production raises difficulties, because the AChE obviously adheres to the cell membrane. To separate the stromas, previously lysolecithin, pancreas extracts and the surface active polyoxyethylenesorbitanlaurate (=Tween 20). The best preparation described so far show however only the specific activity of 42 with low yield. It was possible to obtain the most strongly enriched preparations with a specific activity of 11,000 by chromatographic purification of extracts from the electrical organs of electroporous electricus (electric eel) [172]. Using electrochemical methods in which the blood dye does not interfere, it is possible to use with hemolyzed erythrocytes. The hemolysis takes place by treating the erythrocytes with a saponine solution.

The characterization of the activity of the enzyme preparations takes place in accordance with the nomenclature proposals of the International Union for Biochemistry (1964) as specific activity in enzyme units per milligram protein. The enzyme unit is the amount of enzyme which converts in 1 minute 1 mol substrate (here acetylcholine) under the conditions indicated (here mostly pH 7 to 7.5 and 37 - 38 degrees C). To convert the enzyme dry substance to protein a protein determination must be carried out by the Kjeldahl method.

It is basically necessary before using the enzymatic method on specimen materials to establish a calibration curve or calibration table with the pure inhibitor substance. Maintaining exactly the experimental conditions, including also the composition of the specimen solution corresponding to the later application, the measurement values are obtained, mostly after conversion to percentage inhibition, plotted against the concentration or its negative logarithm.

The method corresponds to the determination of the I50 or pI50 values. In the measurement as far as possible we should work in the region of a 40 to 60 percent inhibition of the enzyme, in no case outside the 20 to 80 percent inhibition. The organic insecticide thiophosphoric compounds are oxidized in vivo to their oxygen analogs or to their sulfoxides and sulfones, which are strong cholineesterase inhibitors. Before the enzymatic determination it is therefore oxidized in vitro; this takes place through the effect of bromine water of N-bromosuccinimide, hydrogen peroxide/acetic acid or silver oxide. The excess bromine is removed by adding some phenol water.

A survey of the most common methods used to determine cholineesterase inhibiting organic phosphoric compounds is given as follows:

I. Methods with Carboxylcholine as Substrate

The visual colormetric method of the measurement of the acetic or butyric acid formed with bromothymol blue is very sensitive /149/. The time elapsing until the color is the same as that of the standard is measured. The inhibition is calculated from:

$$\text{percentage inhibition} = 100 - \frac{tK \cdot 100}{tp};$$

tK - working time of the control specimen
tp - working time of the specimen.

This method is excellent for the field analysis determination of organophosphoric warfare agents because of the small demands which are imposed on the equipment. The standard (reference color) is produced by mixing in a test tube serum solution, the solution to be studied, bromothymol blue and a certain amount of acetic acid. Two other test tubes are also coated with serum solution; in one of them the solution to be studied is poured, in the other unpoisoned water (control specimen). After the incubation time acetylcholine solution is pipeted quickly one after the other into the two tubes and the time noted. After a few minutes the control specimen reaches the color of the standard. The specimen with the solution to be studied reaches in case of an inhibition of the enzyme through the poison present this yellowish green color only after a correspondingly longer time. From the comparisons of these two periods it is possible to calculate the inhibition according to the formula and to obtain from the calibration curves the corresponding inhibitor concentration.

The titrimetric determination of acetic acid from acetylcholine with phenol red as indicator was used to determine 0.1 Ag tabun and sarin per milliliter [150]. The ΔpH method is used very often [156]. To follow very fast inhibition processes, for example in the dialkylaminoalkyl-methylfluorophosphonates, the pH stat method in which the pH value is kept constant with the autotitrater is most suitable. An advantage of this method is that the addition of buffer ions which affect to a certain extent the enzymatic activity, is not needed.

The substrate indicator papers are suitable preferably for the field analysis of warfare agents containing phosphorus [136]. The advantages reside in the very simple manipulation, the low cost, the quick execution, the low requirements in reagent and the large temperature range in which the work can be carried out. Another improvement is represented by papers which contain besides the substrate and the indicator lyophilized serum [151]. Using purified enzymes and dry storage they can be kept for a long time.

In a study by the Dutch Research Center for Defense [173] paper strips are described which are impregnated with serum cholineesterase. According to the effect of the water to be studied, a solution of 2,6-dichloroindophenylacetate is added in drops. If the specimen is not poisoned, the papers quickly assume a blue color; in case inhibitors are present they remain colorless. The limiting concentration indicated is 0.1 μg/ml.

An excellent method for the parallel determination of a large number of specimens is a modified agar diffusion method of Sandi and Wight [152]. Holes are pierced in a smooth layer of agar gel containing enzyme and indicator (bromothymol blue) applied on glass plates and the specimen solution is introduced in them. Diffusion is allowed for a certain time, as far as possible overnight, then acetylcholine solution is poured on it and we obtain on a yellow background, blue circles whose diameter is proportional to the inhibitor concentration of the specimen and allows the recording of a calibration curve. Parathion can be determined by this method up to a concentration of 0.03 μg/ml.

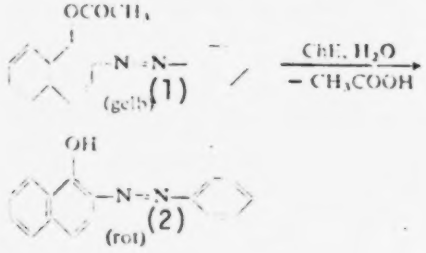
Using the selective electrode already mentioned in section 29.2.2. for acetylcholine ions it is possible to determine paraoxon and amiton in concentrations from 0.01 μg/ml [174]. After an incubation time has elapsed between enzyme and poison acetylcholine is added in a concentration of 2 by 10-3 M and by means of the electrode we find the time during which the substrate concentration has dropped from 1.95 by 10-3 M to 1.85 by 10-3 M. This time depends on the degree of the inhibition of the ChE and is thus a measure of the concentration of the inhibitor.

II. Methods with Carboxylthiocholine as Substrate

The already mentioned electrochemical method [142] which is based on the measurement of the depolarization rate of a platinum electrode was used to determine the organophosphoric cholineesterase inhibitors /153/ while for example for an incubation time of 10 minutes 2 by 10-4 μg sarin or 1 by 10-2 g systox per milliliter could be determined.

III. Methods with Chromogenic and Fluorogenic Substrates

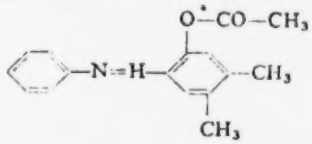
A chromogenic substrate is 2-azobenzol-1-naphthylacetate which is used in association with horse blood serum to determine sarin [159] and gives in the enzymatic hydrolysis at pH 7.4 to 7.8 the red 2-azobenzol-1-naphthol:



Key: (1) yellow; (2) red

After the reaction time has elapsed the enzymatic reaction is stopped by adding acetonic hydrochloric acid and the colored product is determined photometrically.

In a publication by Stachlewska-Wroblowa [175] it is indicated that of a series of acetylester derivatives of the hydroxyazobenzols the following compound is very suitable as a chromatogenic substrate in the enzymatic determination of soman with ChE:



For an incubation time of 10 minutes it is possible to determine 5 by 10-7 mg soman/ml.

Some simple field devices for the detection of nerve damaging chemical warfare agents are based on the splitting of 6-bromo-2-naphthylacetate through AChE to acetic acid and 6-bromo-2-naphthol and its combination with a stabilized diazonium salt into a blue azodye [161].

A very interesting enzymatic method for the detection of vapors and aerosols or organophosphoric warfare agents of the type G and V is described in an American patent [176]. By means of a double enzyme substrate system it is achieved that in the presence of an inhibitor a color is formed. In a mixture of reagents cattle plasma albumin hydrolyzes 3', 5'-dichlorindophenylacetate into blue indophenol; horse serum ChE hydrolyses acetylthiocholine into thiocholine. The latter reduces the indophenol to a colorless substance. Whereas in the absence of an inhibitor the reagent remains colorless. In the presence of poisons it becomes gradually blue because of the slowing down or the total suppression of the acetylcholine hydrolysis. The variation of extinction in the unity of time is the measure of the concentration of inhibitors.

A fluorimetric method for trace determination of organophosphoric insecticides [177] using N-methylindoxylacetate and ChE is interesting because it was shown that the ChE from different sources (human serum, liver, insect heads) is inhibited very differently by the corresponding inhibitors.

The highly sensitive determination of organophosphoric warfare agents is possible with a fluorimetric method established by Matousek [178] using horse blood serum-ChE and indoxylacetate. The excitation of fluorescence takes place with UV light of 355 nm; the maximum of the excited bluish green fluorescent light is obtained at 465 nm. Control tests and specimen are measured three times each at short intervals. From the comparison of the speeds ($V = \Delta\Phi/\Delta t$ (rise of the curve) for the control experiment (VK) and the specimen (Vp) the inhibition coefficient I is determined:

$$I = \frac{Vp}{VK}$$

On the basis of the value obtained I from previously established calibration curves it is possible to determine the concentration of the inhibitor. The limiting concentration indicated for sarin and soman are 1 by 10-7 mg/ml, for VX 2 by 10-6 mg/ml.

29.2.3.1. Detection and Semiquantitative Determination of Organophosphoric Inhibitors in Water with the Substrate-Indicator Paper [136]

Production of the Substrate Indicator Papers:

1.70 gr butyrylcholineiodide and 0.30 g bromothymol blue indicator are resolved in 100 ml 96 percent ethanol. This solution is used to impregnate chromatography paper (surface weight 100 g/m2) by dipping it for 30 s, allowing it to drip and to dry in the horizontal position in the air. After drying it is cut into rectangular pieces of exactly 15 mm by 20 mm by removing the border strips about 5 mm wide and these rectangular pieces will be used for the determinations. 100 ml of the solution are sufficient to produce about 1500 papers. The papers can be kept indefinitely. For the determination we must use each time only papers from the same production batch.

Reagents:

Enzyme solution

A 2 percent solution of lyophilized horse blood serum in Michel buffer, pH 8.0 (0.742 g sodium veronal, 0.082 g potassiumdihydrogenphohsphate and 17.535 g sodium chloride are dissolved in 1 l water free from carbon dioxide, with 0.1 normal hydrochloric acid and the pH value of the solution is adjusted to 8.0). When not in use it is stored in the refrigerator.

Reference Buffer pH 7.0

A phosphate buffer according to Sorensen is used. The production takes place by mixing 39 ml of a solution of 0.078 g potassium hydrogen phosphate in 1000 ml water and 61 ml of a solution of 11.876 g disodium hydrogen phosphate in 1000 ml water.

Procedure:

First the suitability of the paper produced is tested. 0.05 ml each of water and enzyme solution is carried by pipett to a point of a microobject carrier, then 0.1 ml reference buffer is added with the pipett. On both points a substrate indicator paper is placed. The second object carrier is used to cover and the time taken for both papers to have the same color is noted. It should be between 3 and 7 minutes. If it is not in this range, the acid content of the papers or the indicator may be the cause. In this case fresh papers must be produced using a different quality of paper or after adding 0.1 normal sodium hydroxide to the substrate indicator solution until the latter becomes olive brown.

Preparation of the Specimen Water:

The specimen water must be neutralized before the detection. To this end 10 ml are treated with 5 drops of a solution of 0.1 percent bromothymol blue in 20 percent ethanol and adjusted by careful addition of 0.01 normal sodium hydroxide or hydrochloric acid to a greenish-blue shade.

For specimen waters of high degree of hardness differences can arise in the change of color as compared with the control specimen through the buffer effect of the salts contained in the water giving rise to wrong results. Therefore it is proper to use instead of the distilled water for the reference value a part of the specimen water decontaminated with active carbon. The decontamination takes place by adding a generous amount of powdered active carbon with the spatula tip to 5 ml of the specimen water; it is agitated several times within a few minutes, then filtered and neutralized. With this treatment the poison concentration drops by about 3 powers of 10.

Execution of the Detection Process

Two drops of 0.05 ml enzyme solution each are placed with a pipett on a microobject carrier. The left-hand drop is treated with 0.05 ml sampling water, the right-hand one with 0.05 ml reference water. Agitation is carried out with 2 thin glass rods which must be separated strictly from each other and always used on the same side. After an incubation time of 5 minutes for sarin, soman, tabun and DFP or 15 minutes for VX both sides are covered with a paper each and a second object carrier is applied. Whereas the paper on the right-hand side (comparison) gradually changes its color from blue-green to green, yellowish-green, lemon yellow to bright yellow, the left paper (specimen) in the presence of organophosphoric inhibitors remain bluish-green or changes its color much more slowly.

Execution of the Semiquantitative Determination:

The procedure is similar to that of detection only in addition between the specimens and the reference at the center of the object carrier 0.1 ml reference buffer is introduced with a pipette and also covered with a paper after the incubation period. The time elapsing from the application of the paper (the specimen and reference are covered simultaneously with paper, then the buffer) until the color of the reference and the specimen with the buffer is obtained. From this we calculate the inhibition by the following formula:

$$100 - \frac{to \cdot 100}{tp} = \text{percent inhibition;}$$

to = working time of the reference
tp = working time of the specimen

For the individual inhibitors calibration curves are established, while the percentage of inhibition obtained for certain concentration is plotted against the negative logarithm of the concentration. In the central area of the curve (20 to 80 percent inhibition) with exact procedure a very high precision is achieved. An advantage of this method of detection and determination is that the temperature hardly influences the values, the duration of the determination changes mainly, because of the dependence of the speed of the splitting of the substrate on the temperature. The sensitivity of the method is 1 by 10-6 mg/ml for sarin and soman, and 5 by 10-6 mg/ml for tabun.

The central area of the calibration curves from 20 to 80 percent inhibition includes a concentration range of the organophosphoric inhibitors of about 1 power of 10. In many cases it is therefore necessary to start a dilution series. If therefore the paper on the specimen side does not change in color or the working time is more than 30 to 40 minutes, the specimen water is diluted each time 1 to 10 with water free from poison

and an experiment carried out with each dilution stage. The following example should illustrate the calculations needed to evaluate such a determination.

The sarin concentration in a sample water is to be determined. In the experiment carried out with the undiluted sample water the paper did not change its color. The sample water is therefore diluted twice, each time 1 to 10. With the first dilution no measureable working time could be obtained, on the other hand the second dilution gave a working time of 10 minutes. The working time of the reference specimen is obtained as 4 minutes.

The inhibition is calculated from:

$$100 - \frac{4 \cdot 100}{10} = 60 \text{ percent inhibition.}$$

From the calibration curve for sarin for this inhibition a value pI (= negative logarithm of the sarin concentration in milligrams per milliliter) of 5.2 was noticed. The conversion is then carried out as follows:

Sarin concentration = 10-pI
= 10-5.2

lg sarin concentration = 0.8-6
sarin concentration = 6.3 by 10-6 mg/ml

Since the sample water was diluted altogether 1 to 100 it was found that it contains:

6.3 by 10-6 by 100 = 7.3 by 10-4 mg/ml

or

0.63 mg sarin/l.

29.2.3.2. Photometric Determination with Indophenylacetate as Substrate /160/

Reagents:

A. Enzyme buffer solution

Solution of lyophilized horse blood serum in 0.05 molar phosphate buffer of pH 8.0 (40 cholineesterase units according to Ammon per milliliter).

B. Substrate solution

0.08 g indophenylacetate[8] (melting point 115 to 116 degrees C from petroleum ether /124/ are dissolved in 100 ml methanol (3.3 by 10-3 molar solution).

C. Phosphate buffer pH 8.0 according to Clark and Lubs

46.8 ml 0.1 normal sodium hydroxide and 50 ml 0.1 normal potassium dihydrogen phosphate solution are mixed and water is added up to 100 ml.

[8] N-(4'-acetoxyphenyl-)p-quinonimin.

Procedure:

1 ml of the aqueous poison solution is mixed in a test tube with ground stopper with 4 ml enzyme buffer solution (A) and incubated in the thermostat at 30 degrees C in the case of sarin, soman, tabun, TEPP or 30 minutes for the V warfare agents or insecticide phosphoric acid esters. After this period 0.15 ml substrate solution (B) are added. The tubes are left another 30 minutes in the thermostat, then the enzymatic reaction is either timed by adding 1 drop of DFP solution (5 mg/ml) and the measurement carried out subsequently or the extinction is measured immediately after the 30 minutes period. The measurement takes place in the spectralphotometer at 625 nm against a reference specimen which was set up with 1 ml water and 4 ml phosphate buffer (C) parallelly to the specimen. The determination of the inhibitor concentraction in the specimen takes place on the basis of a calibration curve which was recorded with pure substance and in which the inhibitor concentration was plotted against the extinction. The erythrocyte esterase (AChE) more suitable for the determination of some organophosphoric inhibitors can be used in this method; the splitting of the substrate takes place at approximately the same speed.

Instead of the indophenylacetate 2,6-dichlorindophenylacetate can be used; the measurement of the extinction takes place in this case at 610 nm.

29.3. Biochemical Determination of Organophosphoric Inhibitors Using Other Enzymes

The aliesterases contained in the liver of mammals may be used in many ways primarily for the enzymatic detection of organophosphoric inhibitors on paper and thin layer chromatograms. We are dealing with hydrolases which are able to split particularly the esters of short chain aliphatic fatty acids. The substrate used mainly are α- and β-naphthylacetate; the free naphthol obtained in the enzymatic splitting is associated with a stable diazonium salt, for example the fast blue salt B, in a dye.

The inhibition of steapsinlipase through sarin and systox allows the fluorometric determination of these inhibitors using dibutyrylflorescein as substrate [162]. The work is carried out with the 5 by 10-5 molar concentration of the substrate for a pH value of 8.0; for an incubation time of 2 minutes it was possible to determine 3 by 10-5 to 3 by 10-4 mg of the inhibitors per milliliter.

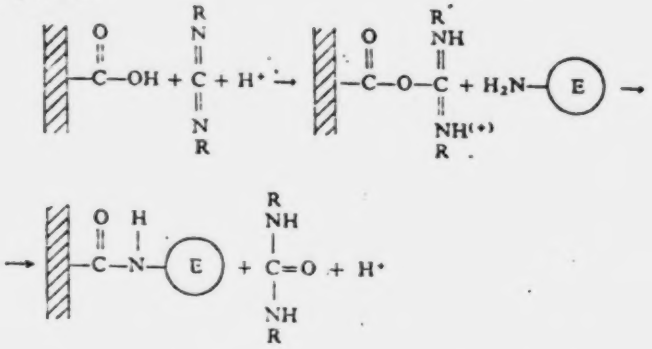
Some ferments in which the substrate splitting is accompanied by the evolution of gas are inhibited in their activity by the organophosphoric inhibitors. The reduction in the amount of gas evolved in the unity of time and whose measurement in the fermentation tube can be achieved with higher sensitivity by adding foam producers is a measure of the inhibitor concentration. Suitable ferments are catalase with hydrogen peroxide as substrate, urease with urea and carboxylase with brenzoracemic acid as substrate [163].

29.4. Carrier Fixed Enzyme and Enzyme Electrodes

The low stability and the relatively high cost combine with the fact that a given amount of enzyme has only been used once are factors which limit the wide use of the enzymes even for analytical purposes. Although the enzyme if no inhibitor were present is fully active once again after completing the reaction as catalyst, up to now it was satisfied each time. These drawbacks can be avoided to a great extent if the enzymes

are bound in a high molecular and generally insoluble carrier. The action center of the enzymes is not concerned in the bond and thus it occurs free so that the substrates are bound and converted more or less without obstacles and the reaction products can be released. By this manner it is possible to stabilize the enzymes and use them more extensively than before because of the possibility of repeated use as catalysts. In particular the thermal stability is increased by inhibiting the autolysis (=self-dissolution). Another advantage is that the reaction sediment remains free from photenes when carrier fixed enzymes are used.

The most important method for carrier fixing of enzymes is the covalent bound on lateral or synthetic carrier substances through reactive groups of the protein, while a large number of possibilities exist. This principle will be elucidated on a typical procedure- In the binding on carboxyl groups of the carrier by means of carbodiimides, the following reactions take place.



Further possibilities of carrier fixing are the adsorption of the enzymes on inert carriers (cellulose, glass, silica gel, organic polymers among others), the electrostatic binding on ion exchangers or copolymerization. For the permanent use of carrier fixed enzymes in automated warning and monitoring plants special requirements are imposed on the preparations. The enzymes must be firmly bound; thus they must not "bleed". The carrier should absorb neither the substrates and inhibitors nor their decomposition products; it should not affect the pH value and must not be attacked by microorganisms.

29.4.1. Carrier Fixed Cholineesterases and their Analytical Application

The first experiments for the application of carrier fixed cholineesterase for the detection of organophosphoric inhibitors were carried out by Bauman and his colleagues [154]. At the same time interesting possibilities were shown for the development of biochemical detectors for organophosphoric chemical warfare agents. The immobilization of ChE (from horse blood serum) is caused by the dissolution in a starch solution, impregnation of a polyurethane foam pad with this solution and subsequent freeze drying. The enzyme remains stable on the pad for 12 hours and showed no extensive decrease of activity. The enzyme pads cut in two a smaller format were used in connection with the electrochemical system described in section 29.2.2. If the butyrylthiocholineiodide solution flows through the pad located between two platinum electrodes, the electrochemical system shows a low potential when a current is applied because of the oxidation of the thiocholine obtained by enzymatic hydrolysis into disulfide on the anode. If the substrate

solution or in air current sucked up simultaneously by the pad containing an inhibitor, the activity of ChE decreases and the potential increases until in case of total inhibition of the enzyme the potential reaches the oxidation of the iodine ion.

These enzyme pads represent together with -naphthylacetate as substrate in a suitable arrangement of the apparatus a possibility for continuous control of air and water for the presence of organophosphoric inhibitors [156]. The constant fluorescence measured with a uniform substrate flow through -naphthol is reduced or extinguished in the presence of inhibitor in the sample water additionally mixed constantly in the substrate solution. A carrier fixed ChE preparation more stable for use was obtained by incorporation in polyacrylamide gel [179]. The control of the activity using N-methylindoxylacetate in tris-buffer (pH 7.4) shows that the preparation was stable with dry storage over 80 days and with discontinuous use for 40 hours.

By covalent coupling of AChE of silanized fritted glass discs very stabile preparations were obtained [180]. The silanization of glass was accomplished with γ-aminopropyltriethoxysilane. By means of the carbodiimide methods then the AChE was coupled with a covalent bond between the amino groups of the aminoalkylsilane glass obtained and the carboxyl group. The enzyme retained in this form in activity over a period of 55 days, while between the different applications the discs were kept each time in phosphate buffer. It was possible to reactivate the original activity to 70 percent for a preparation totally inhibited with paraoxon by treatment with toxogonin.

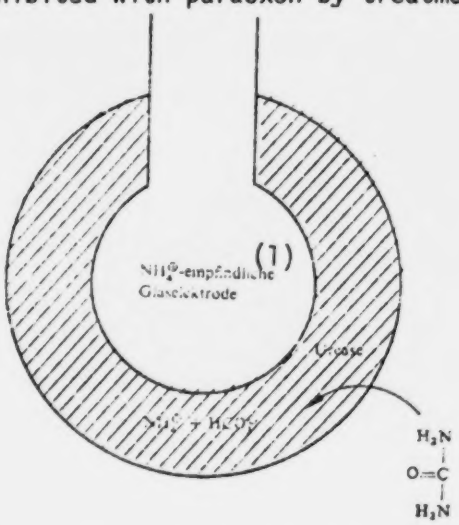


Figure 29.3. Enzyme electrode to determine urea according to the method of Guilbault [181]. Key: (1) NH4 sensitive glass electrode

29.4.2. Enzyme Electrodes

One of the forms of application of carrier fixed enzymes is the use of enzyme electrodes. The latter are based on the fact that the product of the enzymatic substrate separation is often a simple ion, to which the conventional ion selective electrodes react. Since the enzyme effect is highly elective, these enzyme electrodes make it possible to determine individual components in complicated mixtures without previous separation.

One prototype for these electrodes is the enzyme electrode for urea described by Guilbault [18]. The enzyme urease is fixed in a layer of polyacrylamide gel which is held by a nylon fabric or a cellophane membrane on a glass electrode selective for ammonium ions. The urea diffuses in the gel layer; the ammonium ions formed by enzymatic splitting are indicated by the electrode.

So far no report has been made on enzyme electrodes for the detection of poisons, but the development of such electrodes for example for organophosphoryls on the basis of phosphatases combined with the phosphate selective electrodes described already in the literature is quite imaginable.

Check Questions

1. What are the advantages and drawbacks of the biochemical methods for the detection and determination of chemical warfare agents?

2. Describe the known types of esterases separating cholinesters on the basis of their important distinguishing features.

3. Explain the differences in the inhibiting effect of the different organophosphoryls on the cholineesterases.

4. What is the importance of the determination of the activity of cholineesterase in human blood serum?

5. Define the values I50 and pI50.

6. What are the possibilities for determining the I50 value of an inhibitor?

7. Define the "cholineesterase unit" for the cholineesterase activity obtained according to the manometric, electrometric and calorimetric methods.

8. Explain why in the determination of inhibitors the enzyme must first be incubated with the inhibitor and then the substrate added.

9. Why is it necessary to treat parathion with bromine water before the biochemical determination?

10. What is the basis of the determination of the organophosphoric warfare agents with the substrate indicator paper, and how is it to be carried out?

11. What are the advantages of the use of carrier fixed enzymes?

12. Name the possibilities of application of carrier fixed enzymes in the analysis of organophosphoric warfare agents.

30. Biological Methods

30.1. Determination of LD and LC Values

To characterize and compare the toxicity of poisons the data on defined doses or concentrations are used preferably. These data allow very exact and objective comparisons when the investigation were carried out with the same type of application, the same type of animal (while the species of animals, sex, age and weight of the group of animals had to be uniform) and same experimental conditions (time of effect of the poison, environmental conditions, feed, etc.).

The doses used most frequently are the average lethal dose (LD 50), the lethal dose (LD 100) while the data on LD 99 are more exact for statistical reasons as well as the average effective dose (ED 50). Similarly the average lethal concentration (LC 50) and the lethal concentration (LC 100 or LC 99) are indicated.

The LD 50 is defined as a dose which leads to death under defined conditions for 50 percent of the animals used, the LD 100 causes death in all the animals used. The ED 50 gives the dose at which a certain definite effect or reaction can be recorded in 50 percent of the test animals used. The data are given generally in milligrams or grams substance per killogram body weight (mg/kg). All types of application are used.

To determine experimentally the doses or concentrations groups of at least 8 to 10 test animals are administered under constant comparable conditions definite doses of the substance to be studied. The number of animals dying in each group is recorded after corresponding times and statistical or/and graphic methods are used to derive the LD 50 (or other doses and concentrations).

Besides the purely statistically methods [185] or graphic methods of calculation [297] it was decided to determine the doses indicated with a combined graphic and statistical method [298]. To this end the dead animals per group are indicated in percentage of the total number of the animals used and represented in a probability system while the ordinates represent the percentages and the abscissa the dose values in logarithmic scale. The measurement points are joined with each other with a straight line. After correction of the latter by means of a tabulated value it is possible to obtain on this basis the desired dose as well as by additional calculations the limits of reliability for a pregiven probability of error and assure their statistical certainty. The method offers as compared with others the advantage that for a sufficient number of test animals per group relatively exact, statistically certain results can be obtained.

To describe the effect of the antidotes or other measures for protection against poisonings the rate of involution of the LD 50 is often indicated. We mean by this term the quotient of the LD 50 obtained by treatment or prophylaxis and the LD 50 without therapeutic or prophylactic measures. Both doses must be obtained under comparable conditions. The extent of the involution rate is a measure of the efficacy of the protective measures against poisoning.

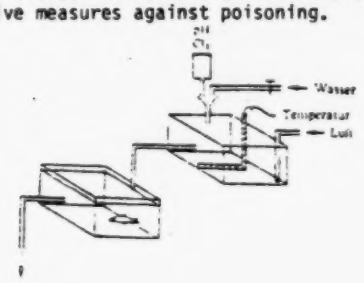


Figure 30.1: Device for water control with fish [182]

30.2. Use of Animals for the Detection of Warfare Agents

Similarly to the use of the subjective powers of observation of man for certain warfare agents an attempt was made especially during the period of the First World War to use the higher sensitivity of the organs of sense of some animals or their physiological reactions to detect the warfare agents. The highly sensitive sense of smell of the dog is for example able to detect even concentrations between 0.1 µg/l of sulfur yperite vapors. It was also possible to train the smelling capacity of dogs and their reaction to differentiated indication of warfare agents as compared with other smells [181]. Cats showed an increased toxic sensitivity to phosgene. The chicken reacts with even greater sensitivity to the slightest traces of phosgene, as it may generally be established that birds show with maximum sensitivity physiological reactions in the presence of poisons in the atmosphere. Canaries can therefore be used as living indicators of prussic acid and carbon monixide. Similarly the American Army during the First World War used snails which in the presence of low concentrations of yperite in the air gave a milky secretion.

Although the use of animals for this purpose has many drawbacks which are due to the lack of the possibility of understanding or the difficulty of evaluation of the behavior of animals deviating from the normal, this possibility is also being studied at present. As is apparent from the civil toxicological and foreign literature on military chemistry, this applies particularly to the identification of the organophosphoric warfare agents and insecticides in water and foodstuffs. Dogs are trained to signal concentrations more than 0.5 mg/m3 of soman, sarin, VX, tabun and CS [300].

Besides the use of mice to obtain toxic data on the compounds, which was described in greater detail in section 30.1, these animals are also used to establish poisons in foodstuffs by means of experiments with feed or by injection of extract. Some species of ornamental fish who show an extremely high toxic sensitivity for organophosphoric warfare agents and insecticides are used to detect these poisons in drinking water and with a suitable device (Figure 30.1) for constant water control in larger processing plants [182, 183].

The LC 50 values for sarin may be found for different periods of effect in Table 30.1.

Since the fish especially in the case of water of low hardness react sensitively to chlorine, the latter is reduced by adding suitable concentrations of sodium thiosulfate (7 mg $Na_2S_2O_3$ per 1 m chlorine). The temperature is kept at 20 to 28 degrees C, the oxygen content at more than 4 mg/l and pH value regulated between 5 and 9. The particularly suitable types are the Pimephales promelas which give very characteristic reactions at low concentrations of the poison (extension of the fins forward, spreading of the gill cover). A concentration of 0.5 mg sarin/l causes in these fish after 6 minutes 50 percent loss of balance in 50 percent of them and after 12 minutes death in 50 percent. In the Leponis macrochirus with a longer period of effect (30 days) it is still possible to detect 0.1 µg parathion/l. Guppies are suitable also to detect traces (5 mg/l) of sulfur yperite dissolved in water [184]. During the Vietnam War the inhabitants of jungle villages after the suspected use of chemical warfare agents and poisons had waited for the reaction of the fish to judge the potability of drinking water.

Table 30.1

Species of Fish	Water	LC 50 in g/l 24 h	48 h	96 h
Pimephales promelas	soft	6.5	5.3	4.4
	hard	32.1	31.9	31.9
Lepomis cyanellus	soft	4.6	4.2	4.2
	hard	15.2	15.2	15.2
Guppies (lebistes reticulatus)	soft	8.3	7.2	7.2
	hard	21.0	14.5	13.8
Lepomis macrochirus	soft	7.5	3.2	3.2
	hard	23.5	23.5	23.5
Carassus auratus	soft	16.1	11.8	9.8

To determine the residue and the insecticides containing phosphorus in plants and foodstuffs it is possible to use fly, leeches and water fleas. The flies are placed mostly in contact with an extract in flat covered glass dishes, the leeches are placed in an aqueous extract. The achievable sensitivities are very high. Since the values depend on the conditions, an indicator value is for example that for a period of effect of 24 hours it is possible that with the leech to detect still 5 γg parathion (after prior oxidation) in 50 ml aqueous solution through the death of the animals. It is interesting to detect toxic organic phosphorus compounds on paper chromatograms by contact of mosquito larvae with the chromatogram divided into regular sections.

Check Question

1. In what form can animals be taken to detect chemical warfare agents and other poisons in water?

31. Physical and Physical-Chemical Methods

The determination of physical constants is used in the analysis of unknown specimens for identification, in the laboratory investigation of known substances it is carried out to control the purity and for synthetic products also to confirm the identity. For solid substances the melting point, in liquids the boiling point, the specific weight, the vapor pressure and the index of refraction are determined. In each case the substance is purified extensively before determining the constants by recrystallization, sublimation, distillation or by preparative chromatography.

The spectral analytical study, especially in the infrared region of the spectrum offers the most perfect possibility for describing known and identifying unknown substances. The infrared spectrum of a pure substance is quite comparable in its specificity with the evaluation of a fingerprint in criminal investigations.

Although the physical methods are inferior to the chemical ones of analysis as regards precision, they offer significant advantages as regards shortening the time needed, reducing manual work and in the sensitivity. Table 31.1 which was taken from the publication by H. Kienitz [232] allows the comparison between some chemical and physical methods of quantitative analysis.

31.1. Determination of the Specific Weight

For the determination of specific weight of liquid warfare agents the pycnometer is suitable. The following weights are determined:

a) pycnometer, filled with substance = A
b) pycnometer, filled with water = B
c) empty pycnometer = C

From this we calculate the density in g . cm-3

$$\varrho = \frac{A - C}{B - C}$$

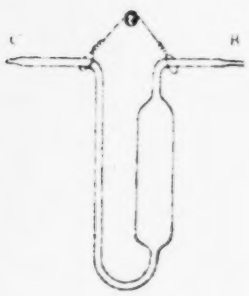


Figure 31.1: Pycnometer according to Sprengel/Ostwald.

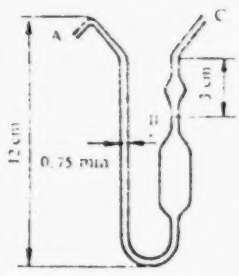


Figure 31.2: Self-filling pycnometer according to Hennion /225/

Table 31.1. Comparison Between Some Quantitative Methods of Analysis

Methode (1)	analytische Aufgabe Nachweis oder Bestimmung (2)	Probenmenge (3) ohne Anreicherungsverfahren P in mg	ungefähre Erfassungsgrenze (4) E in mg	Wirkungsgrad der Methode (5) (11) W = P/E	Genauigkeit des Analyseergebnisses (6) rel. in %	Dauer der Analyse (7) (ohne Vorbereitung) manuelle Arbeit (8) in min	Auswertung (9) in min	Bestimmungsdauer einschl. Auswertung (10) in min
anorganische Makrogewichtsanalyse (12)	Elemente (22) Anionen (23) Kationen (24)	100 ... 500	0,1	10^3	0,2 ... 0,5	20 ... 120	2 ... 5	60 ... 300
anorganische Mikrogewichtsanalyse (12a)	dto.	3 ... 10	0,002	10^3 ... 10^4	0,5	30 ... 120	2 ... 5	60 ... 300
anorganische Makromaßanalyse (12)	dto.	20 ... 500	0,1	10^3 ... 10^4	0,2 ... 0,5	2 ... 20	2 ... 5	5 ... 25
anorganische Mikromaßanalyse (12)	dto.	3 ... 10	0,001	10^3 ... 10^4	0,2 ... 0,5	2 ... 20	2 ... 5	5 ... 25
Kolorimetrie (13)	dto.	0,1 ... 1	0,0001	10^3 ... 10^4	1 ... 2	2 ... 5	2 ... 5	5 ... 10
organisch-chemische Makroanalyse (14)	funktionelle (25) Gruppen, Moleküle	200 ... 1000	0,1	$2 \cdot 10^3$ ... 10^4	0,2 ... 0,5	10 ... 240	5 ... 10	15 ... 250
organisch-chemische Mikroanalyse allgemein	dto.	3 ... 10	0,002	10^3 ... 10^4	0,2 ... 0,5	5 ... 150	5 ... 10	10 ... 160
organisch-chemische Mikroelementaranalyse (14a) (14b)	C, H, N, O, S, Cl anorganische (26) Verbindungen	3 ... 5	0,01	10^{+3}	0,3 ... 1	20 ... 40	2 ... 5	25 ... 45
anorganische und organische Tüpfelanalyse (15)	Elemente, Anionen, Kationen, funktionelle Gruppen (27)	0,01 ... 0,1	0,00001	10^3 ... 10^4	qualitativ (30)	1 ... 2	–	1 ... 2
Gaschromatografie (16)	Moleküle (28)	0,5 ... 10	0,0001	10^3 ... 10^5	1 ... 3	5 ... 60	5 ... 15	10 ... 75
IR-Spektroskopie (16a)	funktionelle Gruppen (29)	0,5 ... 5	0,005	10^2 ... 10^3	1 ... 2	5 ... 10	10 ... 30	15 ... 45
Flammenfotometrie (17)	Elemente	1 ... 10	0,0005	10^3 ... 10^4	1 ... 2	1 ... 2	2 ... 5	3 ... 10
Emissionsspektrometrie (18)	Elemente (22)	0,1 ... 1	0,00005	10^4 ... 10^5	2 ... 3	1 ... 2	2 ... 10	3 ... 15
Röntgenfluoreszenzspektrometrie (19)	Elemente	100	0,01	10^4	2 ... 5	1 ... 2	2 ... 10	3 ... 15
Massenspektrometrie (20)	Elemente, (22) Moleküle (28)	0,1 ... 10	0,0001	10^3 ... 10^5	1 ... 2	10 ... 20	10 ... 50	15 ... 60
Neutronenaktivierungsanalyse (21)	Elemente (22)	1 ... 100	10^{-8}	10^6 ... 10^8	5 ... 10	10 ... 60	15	25 ... 1000 Bestrahlungsdauer 10 ... 1000 min (31)

Key:
(1) method
(2) analytical problem detection or determination
(3) amount of specimen
(4) approximate detection limit
(5) degree of efficiency of method
(6) precision of the results of analysis
(7) duration of analysis (without preparation)
(8) manual work
(9) evaluation
(10) determination of duration including evaluation
(11) without enrichment
(12) inorganic macroweight analysis
(12a) inorganic microweight analysis
(13) colorimetry
(14) organic and chemical macroanalysis in general
(14a) organic and chemical microanalysis in general
(14b) organic and chemical microelementary analysis
(15) inorganic and organic spot analysis
(16) gas chromatography
(16a) IR spectroscopy
(17) flame photometry
(18) emission spectrometry
(19) x-ray fluorescence spectrometry
(20) mass spectrometry
(21) neutron activation analysis
(22) elements
(23) anions
(24) cations
(25) functional groups, molecules
(26) inorganic compounds
(27) elements, anions, cations, functional grps.
(28) molecules
(29) func. grps.
(30) qualitative
(31) time of irradiation

The ordinary pycnometers have the considerable drawback when working with warfare agents that some liquid mostly emerges when the capillary is placed on the slide. The pycnometers according to Sprengel/Ostwald are more suitable (Figure 31.1). The liquid is sucked up through the opening A (rubber ball or glass injection flask with rubber hose) in B there is a mark to which the liquid is adjusted by swabbing the excess liquid in A with a cell plug swab. It is very advantageous when working with toxic liquids to have the cell filling pycnometer according to Hennion [225] which can easily be made with a complete pipette of suitable size (Figure 31.2). The capillary tip A is dipped in the liquid; after the pycnometer is full to the calibrated mark B, the opening C is closed with a finger and after wiping the tip A it can be weighed.

31.2. Determination of the Melting Point

To determine the melting point the substance is filled in a glass melting point capillary and the latter is heated in the glass equipment according to Thiele in a sulfuric acid bath or for chemical warfare agents preferably in the copper or aluminum block. The filling in the capillary takes place over a glass plate which is subsequently decontaminated. It is very advantageous for rapid determination of the melting point in warfare agents which decompose with slower heating, to use a heating bench proposed by Kofler. It consists of a metal body about 4 cm wide and 30 cm long, at which a temperature gradient is produced by unilateral electrical heating. The temperature gradient is approximately linear. The substance is scattered directly over the chromium plated surface of the heating bench. According to the purity of the substance a more or less sharp limit is immediately clear between the liquid and solid phase. When working with melting point capillaries the determination of the melting point can be arranged exactly, by determining in a preliminary experiment the approximate position and in a second experiment adjusting the capillary only a few degrees below the value obtained in the equipment in the preliminary experiment. To determine the melting point in the presence of very small amounts of substance, a few crystals are needed, the work is carried out with a microheating table under the microscope with which it is also possible to identify much better the impurities in the specimen substance and the formation of eutectic mixtures with the main components than in the melting point capillaries. A substance is considered pure when the melting point after recrystallization has not changed by more than 1 degree C. A sure criterion of the identity of a substance is the mixed melting point. Equal parts of the specimen substance and the substance which could occur as a result of the melting point are mixed intimately by crushing. If the melting point of the mixture corresponds to the known substance of the mixture the specimen substance is identical to it.

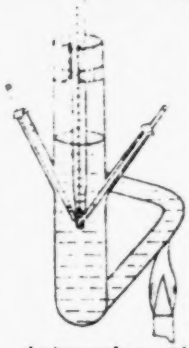


Figure 31.3: Glass equipment to determine the melting point according to Thiele.

31.3. Determination of the Boiling Point

The method to be chosen to determine the boiling point depends on the amount of the substance to be studied available. For field analysis warfare agent studies, the amount of specimen is generally very small and the use of a micromethod is necessary. A glass tube of about 6 mm diameter which is attached with a rubber ring on a thermometer is very suitable. The tube contains the capillary tube sealed at the upper end and dipping in the specimen liquid. When heating in the heating bath or with the burner when the boiling temperature of the specimen is reached a uniform current of fine vapor pearls is formed of the capillary.

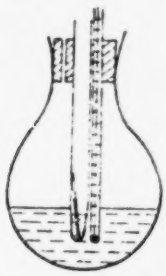


Figure 31.4: Determination of the boiling point.

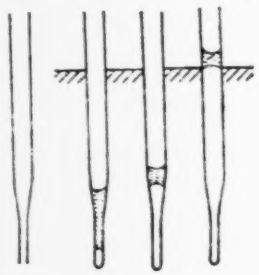


Figure 31.5: Boiling point tube according to Emich.

Another possibility is the determination with the boiling tube according to Emich. A capillary about 8 cm long of 1 mm internal width is drawn out with a microburner to a 2 cm long tip, with which it is possible to suck up some specimen substance.

Then the tip is melted in such a way that a small air bubble remains between the melted end and the liquid. The capillary is attached to a thermometer and introduced in a melting point equipment. When the boiling point is reached the air bubble rises to the liquid level of the heating bath. At that time the temperature is noted.

These methods described give reliable values only for pure substances which boil without destruction at normal pressure. For mixtures the boiling points of the components are determined during a fractionating distillation. The boiling point of chemical warfare agents which is very high under normal pressure (more than 200 degrees C) and which boil with destruction is obtained by vacuum distillation in a suitable microequipment. To evaluate the purity of the specimen it is sufficient to establish that under constant pressure most of it is transformed in a narrow temperature range. The exact determination of the boiling point of this substance under normal pressure is achieved by distillation at two different reduced pressures and calculation based on the dependence of the vapor pressure on the pressure.

The survey of the different methods of calculation and the constants needed for them may be found in the publication by Krell [202].

31.4. Determination of the Vapor Pressure

Two types of methods can be differentiated to determine the vapor pressure:

a) Static Methods

The substance to be studied is brought to a certain temperature which is to be kept constant and the vapor pressure adjusted with a thermal equilibrium of both phases is determined with a pressure measuring equipment.

b) Dynamic methods

The pressure is kept constant with a manostat and the temperature of the substance to be studied increased up to boil. The vapor pressure at boiling temperature is equal to the adjusted pressure.

The dynamic methods include the transfer method in which the gaseous phase corresponding to the measurement temperature which is in equilibrium with the liquid or solid phase of the substance to be studied, is recorded in amount. An indifferent gas current is sent through the substance to be studied. With suitably slow speed of flow the saturation pressure of the substance is adjusted as a partial pressure. The vapor carried is separated by condensation and freezing and can be determined by weighing or it is bound chemically and determined by a quantitative analytical method. The latter method is suitable for the determination of very low vapor pressures up to less than 10-4 Torr and was used also to determine the vapor pressure of sulfur yperite /226/. A simple method which is not very exact but is sufficient for many purposes is the determination of the boiling point at at least two different pressures. From a curve in which the log p (Torr) is plotted against 1/T (K-1), the vapor pressure can be interpolated for the different temperatures. To determine exactly very low vapor pressures methods have been described in the literature /204, 205/ which require a considerable apparatus cost. A simple device and convenient to operate described by Drewes allows the determination of the vapor pressure of liquids from 1 Torr at any temperatures. Only a small amount of mercury and the substance to be studied is needed and the measurement vessel can be produced so cheaply that it can be destroyed after use. The method can be applied in all laboratories which have an oil vacuum pump. Figure 31.6 shows the structure of the device. Figure 31.7 shows the measurement equipment. The measurement equipment is in a thermostatic bath during the measurement. The entrance opening of cock B is drawn into a fine nozzle. As shown in Figure 31.7 the measurement container is filled with mercury. After the vessel is connected with the instrument it is evacuated, and after the mercury level has dropped somewhat in the closed arm of the measurement equipment, it is aerated through the three-way cock C. By careful tilting the air bubble formed above the mercury is eliminated. Thereafter a few drops of the substance to be studied are added to the measurement vessel and sent over the mercury by tilting in the closed arm. After repeated evacuation and aeration the air bubble formed once again is removed; it does not matter that part of the substance here is also removed. Now the measurement instrument is tempered and the equipment once again evacuated. By means of the cock B the vacuum is regulated in such a way that the mercury in both arms is at equal level; the value read in the manometer D corresponds then to the vapor pressure of the substance at the temperature of the bath. By stagewise increase of the temperature and corresponding adjustment of the vacuum it is possible to determine the temperature dependence of the vapor pressure. If at very low vapor pressure the vacuum of the pump is not sufficient to bring the mercury level of the measurement level to the same height, we adjust to any exactly noted value of the scale on the measurement equipment and the vapor pressure is obtained from the difference of the millimeters read on the manometer d and on the scale of the measurement vessel.

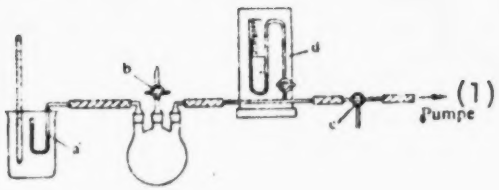


Figure 31.6: Equipment to determine vapor pressure according to Drewes.
Key: (1) pump

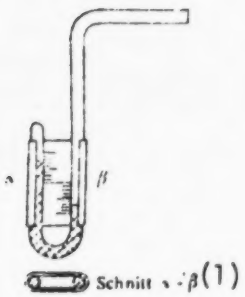


Figure 31.7: Measurement vessel to determine vapor pressure.
Key: (1) cross-section

31.5. Determination of the Index of Refraction

If the temperature and wavelength of the light are kept constant during the measurement of the index of refraction, the measured value can be considered within certain limits as a material constant and be used to characterize organic substances. The index of refraction can moreover be used to determine quantitatively the concentration of a solution or to analyze binary liquid mixtures.

By the combination of the index of refraction with another quantity dependent on temperature, the density, it was possible for Lorentz and Lorenz to introduce theoretically and practically with the so-called molar refraction an absolute constant dependent on the temperature only to a very small extent.

$$R_M = \frac{n^2 - 1}{n^2 + 2} \cdot \frac{M}{\varrho};$$

n: index of refraction
M: defined or assumed molecular weight
ϱ: density

The molar refraction should be obtained according to their original theoretical concept by addition from the atomic refractions. Many practical studies have shown however that this additivity is only valid with good approximation since the effects which are more or less effective of the binding conditions and the molecular structure were not taken into account in their calculations. It was therefore recently decided to add the binding refractions. A survey of such binding refractions calculated mainly by Vogel [200] and Sayre [201] is found in Table 31.2.

Eisenlohr and Woehlisch shows that for the so-called molecular refraction coefficients M by n20D, therefore for the product of the molecular weight and the index of refraction measured at 20 degrees C for the line D, the same additive properties apply as for molar refraction. On this basis the constants indicated in column 3 of Table 31.2 were calculated from which, according to:

$$n_D^{20} = \frac{S}{M}$$

(in which S is the sum of the binding refraction constants) the index of refraction can be obtained.

Bindung (1)	Bindungs-refraktion Linie D', und 20°C (2)	Bindungs-refraktion Konstante (3)
P—C	3,575	25,57
P—Cl	8,856	68,57
P—H	4,010	16,16
P—O	3,102	28,11
P→O	−1,032	22,17
P—S	7,583	47,07
P→S	6,866	54,26
P—F		34,98
P—N		29,28
C—H	1,676	3,87
C—C	1,296	12,86
C=C	4,17	9,39
C—C (Sechsring) (4)	1,27	
C—C (Aromat) (5)	2,688	
C—F	1,55	
C—Cl	6,51	56,80
C—Br	9,39	124,51
C—O (Äther) (6)	1,54	
C—O (Azetale) (7)	1,46	
C=O	3,32	29,39
C=O (Methylketone) (8)	3,49	
C—S	4,61	32,84
C=S	11,91	
C—N	1,57	
C=N	3,76	
O—H (Alkohole) (9)	1,66	13,15
O—H (Säuren) (10)	1,80	10,54
S—H	4,80	
S—S	8,11	
S—O	4,94	37,1
S→O	−0,20	20,84
N—H	1,76	7,26
N—O	2,43	
N→O	1,78	
N—O	4,0	32,26
N—N	1,99	
N=N	4,12	

Table 31.2: Binding refractions and constants.
Key: (1) Bond; (2) Binding refraction, line D and 20 degrees C; (3) Binding refraction constant; (4) six-membered ring; (5) aromatic substance; (6) ether; (7) acetals; (8) methylketones; (9) alcohol; (10) acids.

The determination of the index of refraction is carried out with the Abbe refractometer. The instrument is here under the outlet. The cleaning is carried out with careful and thorough washing of the prisms with cotton plugs, which were impregnated with alcohol. The plugs are placed in a vessel and subsequently burned. The microrefractometer described by Jelley is very suitable, since work can be carried out with very small amounts of liquid. Its structure is very robust and it allows the determination from n = 1.33 to n = 1.92 with a precision up to the third decimals.

31.6. Methods of Spectral Analysis

The absorption spectroscopy in the visible and ultraviolet region of the spectrum is one of the oldest physical methods to clarify the structure of organic compounds and in the form of visual colorimetry and photometry one of the most commonly used methods to determine the concentration of colored or fluorescent compounds. The absorption of light in this spectral range, that is from 400 to 1000 nm (visible region) and from 200 to 400 nm (UV) is caused by the excitation of the loosely bound valency electrons into excitations. Such molecules show an absorption which contain chromophoric groups[9], through conjugation of several of these groups and simultaneous presence of auxochromic groups[10] it is considerably reinforced. The firmly bound valency electrons in the region below 200 nm, the so-called vacuum or Schumann UV is excited into oscillations and excitations of the still firmly bound inner electrons close to the nucleus take place only in the x-ray range.

The spectra in the visible and UV range are not very marked and have mostly only a few maxima and minima. Limits are therefore imposed on their use to characterize organic compounds. An important advance was obtained by the opening of the infrared or ultrared region of the spectrum or molecular spectroscopy which was rendered possible by the improvement of the thermal elements acting as detectors for thermal radiation to the maximum sensitivity and the extensions of the resolving capacity of the monochromators.

The infrared region extends from the red end of the visible region to the region of short electromagnetic waves. The region from 0.75 to 3 by 10-6 is called near infrared, from 3 to 40 by 10-6 m as middle infrareds, then follows the remote infrared. The absorption in the near and middle range is based on the consistency of the oscillation frequencies of the molecules with the frequencies of the waves of this region. In the remote infrared the rotation movements of the molecules around the main axis of inertia are effective. In the same spectral region the Raman spectra are also measured. Their occurrence is based on the polarization of the molecules through oscillations and rotation. The Raman spectra are found in the spectrum of scattered light besides the frequencies of the primary light. They are just as important for investigating the structure of the molecules as the infrared spectra, but their measurement requires considerable cost for equipment because of the low intensity and has not yet been

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[9] Because of the presence of chromophoric groups in the molecule a compound appears colored. Examples of such groups are the nitro group (-NO2), the azo group (-N=N-) or systems with conjugated double bonds, that is double bonds within which there is a simple bond.

[10] The auxochromic groups designate in the dyestuff theory substitutes with free electron pairs which by their entrance into the chromogens (aromatic radicals, which are colored with a chromophoric group) cause a reinforcement of the color intensity and a deepening of the color. Examples are the amino group (-NH2) and the dimethylamino group (-N(CH2)2).

generally introduced. As compared with the spectra in the visible and ultraviolet range the infrared spectra, even for substances for simple structure, in accordance with the many theoretically calculated possibilities for oscillation and rotation are very rich in maxima and minima and their evaluation requires a lot of experience.

The absorption spectroscopy can be used for the identification of unknown and the determination of known substances, in this last case the intensity depending on the concentration of a maximum characteristic for the substance to be determined is measured.

The photography of the UV spectra takes place in UV-permeable dishes in dilute solution in a nonabsorbing solvent, for example n-hexane. IR spectra of gaseous and liquid substances are recorded using dishes, whose windows consist of the halides of alkaline and earth alkali elements. Solid substances are mixed with potassium bromide and compressed and the blanks are introduced in the IR spectrographs.

Besides the high specificity the methods of absorption spectral analysis have the further advantage that the specimen substances are not changed by the measurement and are available for further studies. The recording of a spectrogram for the purpose of identification and characterization of a compound is naturally only practical if it is possible to obtain the specimen substance with highest purity.

31.6.1. UV Spectroscopy

Extensive studies on the characterization and determination of chemical warfare agents by UV spectroscopy were carried out from 1936 to 1944 by Mohler [287]. Different authors had established the UV spectroscopy for determining the organophosphoryls, including parathion and sarin [288] and other poisons. A survey of some of the characteristic absorption maxima in the UV and the vacuum UV given in the literature for some warfare agents and poisons may be found in the following table:

Compound	λ in nm	Compound	λ in nm
bromacetone	209	ethyldichloroarsine	249
bromomethylethylketone	212	2-chlorovinyldichloroarsine	214
ω -chloracetophenone	198	bis-(2-chloroethyl)-thioether	202
xylylbromide	199	parathion	274
bromobenzylcyanide	about 244	paraoxon	270
diphenylchlorarsine	271	DFP	261
diphenylcyanoarsine	226	LSD	312
adamsite	198	N-methyl-3-piperidylbenzilate	258
chloropicrin	205		

Table 31.3: Absorption Maxima in UV

Table 31.4: IR Absorption Bands for Organic Phosphorus Compounds

Frequenz (cm^{-1}) (1)	Struktur (2)	Schwingung (3)	Art (4)
460 ... 574	P—S—X (X = H, C, P)		
493 ... 617	P—S—X (X = H, C, P)	P—S	
420 ... 587		P—Cl	
513 ... 565	O=P—Cl	P—Cl	
(5) etwa 515	S—P—S—C	P—S	
526 ... 649	P—S—H	P—S	V
etwa 538	S—P—S—C	P—S	V
570 ... 600	$R_1R_2R_3C$—S	C—S	
etwa 571	O—P—S—C	P—S	V
600 ... 700		C—S	
600 ... 750	P=S	P=S	
600 ... 630	R_1R_2CH—S		
etwa 606	O—P—S—C	P—S	V
625 ... 645	C—SP	C—S	V
630 ... 660	R—CH_2—S		
650 ... 750	P-Alkyl	P—C	(11) V
685 ... 705	CH_3—S		
702 ... 730	P—NR_2	P—N	V
etwa 715		P—N	
720 ... 750	P—O-Alkyl	P—O	sym. V
740 ... 800	P—F	P—F	(7) 3-wert. P
787 ... 840	P=S	P=S	V
788 ... 820	P—O-Alkyl	P—O	V
815 ... 940	P—F	P—F	(8) 5-wert. P
etwa 800	$(CH_3)_2C$		(9) Gerüstschw.
865 ... 940	O=P—F		
909 ... 971	P—O—C_3H_7—i		
925 ... 1005	Zyklohexan (6)		(10) Ringschw.
900 ... 980	P—O—P	P—O	
950 ... 1018	P—O—CH		
970 ... 1025	P—O-Alkyl	P—O	(14) asym. V
987 ... 1042	P—O—CH_2		
989 ... 1006	P—N—C	N—C	V
995 ... 1050	P—O-Alkyl	O—C	V
1000 ... 1055	Zyklohexan		Ringschw.
1015 ... 1060	P—O—CH_3		
etwa 1030	P—O-Aryl		
1040 ... 1060	—S=O		
1087 ... 1190	CH—O—P		
1105 ... 1170	CH_2—O—P		
1109 ... 1114	P—O—C_3H_7—i		

Key: (1) frequency (cm-1); (2) structure; (3) oscillation; (4) type; (5) about; (6) cyclohexane; (7) trivalent; (8) pentavalent; (9) structural oscillation; (10) aromatic substances; (11) valency oscillation; (12) deformation oscillation; (13) symmetrical; (14) asymmetrical.

Table 31.4 (Continued)

Frequenz (cm^{-1})	Struktur	Schwingung	Art
1140 ... 1170	$(CH_3)_2C$		Gerüstschw.
1140 ... 1160	$-SO_2-$		
1140 ... 1180	$-SO_2-N-$		
1143 ... 1163	$P-O-C_2H_5$		
1145 ... 1200	$-O-SO_2-$		
1146 ... 1149	$P-O-C_3H_7-i$		
1150 ... 1230	$-O-SO_2-O$		
1150 ... 1210	SO_3H und SO_3		
1150 ... 1163	P-O-Aryl		
1156 ... 1163	P-O-Äthyl		
1168 ... 1200	CH_3-O-P		
1165 ... 1175	$(CH_3)_2C$		Gerüstschw.
1170 ... 1310	P=O	P=O	V
1184	$P-O-C_3H_7-i$		
1187 ... 1193	$P-O-CH_3$		
1190 ... 1240	P-O-Aryl		
1200 ... 1250	$(CH_3)_3C-R$		Gerüstschw.
etwa 1228	$P-C_2H_5$		
1245 ... 1255	$(CH_3)_3C-R$		Gerüstschw.
etwa 1280	$P-CH_3$	P—C	D (12)
1310 ... 1320	$P-CH_3$		
etwa 1340	—CH—	C—H	D
1300 ... 1350	$-SO_4-$		
1300 ... 1350	$-SO_2N-$		
1330 ... 1420	$-O-SO_2$		
1350 ... 1440	$-O-SO_2-O-$		
1365	$-C-(CH_3)_3$	C—H	
1365 ... 1370	$-C-(CH_3)_2$	C—H	
1370 ... 1380	$-C-CH_3$	C—H	D sym. (13)
1380 ... 1385	$-C-(CH_3)_2$	C—H	D
1385 ... 1395	$-C-(CH_3)_3$	C—H	D
1435 ... 1450	P-Aryl		
1430 ... 1470	$-C-CH_3$	C—H	D asym.
1445 ... 1485	$-CH_2-$		
1470 ... 1500	$-N-C=S$		
2215 ... 2260	$P-C\equiv N$	C≡N	V
2350 ... 2440	P—H	P—H	V
2525 ... 2735	P(O)OH	O—H	
2550 ... 2600	—S—H	S—H	
2560 ... 2700	P—OH	O—H	V
2843 ... 2863	CH_2	C—H	V
2862 ... 2882	CH_3	C—H	V
2880 ... 2900	CH	C—H	V
2926	CH_2	C—H	V
2962	CH_3	C—H	V
3080 ... 3160	Aromaten	C—H	V
3150 ... 3400	P—N—H	N—H	V

31.6.2. IR Spectroscopy

The infrared spectrum arises through the interaction between the electromagnetic radiation and matter, molecules and atoms. It is an absorption spectrum which arises through the conversion of radiation energy into the energy of the material particle. The energy of the infrared radiation is so small that its interaction with the material particles leads only to a change of the rotation oscillation states in the molecule and therefore to the formation of a molecule rotation oscillation spectrum. When the radiation reaches the material particle changes take place both in the rotation and the oscillation state of the molecules. In this connection some individual atoms or groups of atoms are excited which, since the transition from one rotation oscillation state to another is bound with the satisfaction of the conditions following from quantum mechanics, form as a function of the wavelength, wave number or frequency, an infrared absorption spectrum.

In recent literature the infrared radiation is characterized almost exclusively through the wave number which is defined as the number of waves occurring over a distance of 1 cm. It is related with the wavelength λ by the relation $\nu = 1/\lambda$, if λ is expressed in centimeters and has the dimensions consequently of cm-1.

The oscillations can occur on one hand as valency oscillations, that is oscillations in the direction of the bond, on the other hand as bending, twisting, pitching, and rotating oscillations. The latter is often grouped under the term deformation oscillations.

Besides these basic oscillations in the spectrum harmonics and combination oscillations also occur but they are mostly much weaker. The assumption for the indication of an oscillation is the absorption of the infrared radiation which occurs only when the oscillation is involved with the change of a dipole moment.

The great important which organic phosphorus compounds have assumed as insecticides and softeners, both in medicine, pharmacology and military chemistry suggested very thorough investigations of their IR spectra. After the assignment of the observed maxima (absorption bands) to the individual oscillations, that is the relationship between the structure and IR spectrum had been clarified, subsequently various practical problems were solved by means of the IR spectroscopy, such as the study of the hydrolisis of tabun [289] and the control of purity and study of the stability of sarin [290].

The Table 31.4 was established from many literature data. It gives in orderly sequence a survey over the position of the absorption band for organophosphoric compounds. It is striking to note that a more or less large frequency range is indicated for an oscillation. This is to attributed on one hand to the fact that different substitutes in the molecule contribute to the shift of an absorption band, on the other hand it may be due to the use of different types of equipment in the recording of the spectra.

An idea of the distribution of the absorption band should be obtained from Table 31.5 which was taken by a publication of Lorquet and Vassart [290].

To identify the substances however the assignment of the bands alone is not sufficient, only direct spectrum comparison allows a clear identification of the substance occurring.

Another possibility of applying IR spectroscopy besides identification is mainly the quantitative determination based on the Lambert-Beer law.

$$\ln \frac{I_0}{I} = \varepsilon \cdot c \cdot d = E$$

Io = radiation intensity before the test
I = radiation intensity after carrying out the test
ε = extinction module (material parameter depending on wavelength)
c = concentration (mol/l)
d = layer thickness of the dish (cm)
E = extinction

Table 31.5 IR Spectrum of Sarin

Frequenz in cm^{-1} (1)	Intensität (2)	Schwingung (3)	zugeordnete Art (4)	Gruppe (5)
720	st	P—C	sym. V (14)	P—O—C
777	m-st	P—O	V	P—O—C
840	sst	P—F	V (8)	P—F
880	schw			
905	sst (10)		K (9)	O—C_3H_7—i
925	sst			
1015	sst	O—C	V	P—O—C
1105	st (11)		K	O—C_3H_7—i
1145	m (12)		(6) Gerüstschwingung	$C(CH_3)_2$
1160	m		K	O—iC_3H_7
1280	sst	P=O	V	P=O
1320	sst	C—H	asym. K (15)	P—CH_3
1360	schw (13)	C—H	K	—C—H
1380	m			CH_3 der Isopropoxy-
1390	m			gruppe (7)
1420	m	C—H	K	
1455	m			CH_3
1470	breit			
2854	sst			
2922	schw	CH	V	—CH_3
2965	st			

Key: (1) frequency in cm-1; (2) intensity; (3) oscillation; (4) assigned type; (5) group; (6) structural oscillation; (7) CH3 of the isopropoxy group; (8) valency oscillation; (9) bend oscillation; (10) very strong; (11) strong; (12) medium; (13) weak; (14) symmetrical; (15) asymmetrical

The evaluation of the spectra using a strong and clear band can be carried out according to the baseline method, compensation method or the method of the difference in extinction. The details may be obtained in the relevant specialized literature.

To provide for deviations from the Lambert-Beer law, the work is carried out advantageously with calibration curves in which the absorption is plotted as a function of the concentration of the corresponding substance.

For the quantitative infrared spectrometric determination of organophosphoric compounds it is preferable to use the very intense absorption band at about 980 cm-1 occurring for all organic compounds of pentavalent phosphorus and which were assigned by Bellamy [29] to the P-O bond.

Because of the high reproducibility of the measurement values, the fast and clean procedure and the precision of the indications, the IR spectroscopy can be applied advantageously for reaction kinetics investigations and for determining the reaction mechanisms. The drawback is that because of the dish material and the self-absorption of the water it is impossible to work in aqueous solutions.

Section 32.3.3. reports on the field application of IR spectroscopy.

31.7. Separation and Identification by Chromatographic Methods

Chromatography is an important physical and chemical method of separation in which the substances are separated generally through the differences in the adsorption equilibria with a solid phase or through the different distribution between two liquid or one gaseous and one liquid phase. In many cases both adsorption and distribution are simultaneously effective. The distribution of the substances takes place between immobile phase and a stationery phase. The mobile or moving phases are solvent, or in the special case of gas chromatography, a carrier gas, while the stationary phases used are adsorbers or liquids fixed on a solid carrier. Special forms of chromatography are ion exchange chromatography and the separation method with molecular sifting or gel filtering. The most extensively applied method so far are column, paper and thin layer chromatography, also gas chromatography.

31.7.1. Column Chromatography

The stationary phase at which suitable adsorbers such as silica gel and aluminum oxide or cellulose powder and ion exchanges are used is in a tube. On this column first the mixture of substances to be separated is placed in a dissolved form, then the mobile phase. By adsorption or distribution spatially separate zones of the individual components of the substance are formed which are obtained either after decomposition of the column or on the basis of the different phases in time with which they emerge from the mobile phase of the column. The column chromatography allows the purification and separation of the amount of substances prepared.

The liquid column chromatography has made enormous progress in recent years. With liquid chromatography all substances which can be dissolved in suitable solvent can be analyzed. Thus less limits are imposed on the use of liquid chromatography than for gas chromatography, in which only substances which occur in the gaseous form or can be evaporated will be detectable. The development especially of the liquid column

chromatography. But the development in particular of liquid column chromatography was limited hitherto by the want of highly sensitive and rapid indication detectors for the qualitative and quantitative measurement of the fractions leaving the column. Because of the discovery of such suitable detectors as for example the ultraviolet photometer detector, limiting concentrations up to less than 1 by 10-1 mg/ml can be detected and through the development of high pressure liquid chromatography the liquid column chromatography is assuming increasing importance. Through the increase in pressure the speed of flow of the mobile phase is increased and the time of analysis reduced considerably.

The impurities contained in technical sarin such as pyroester, hydrofluoric acid, methylphosphonic acid and other organic acids containing phosphorus can be removed by means of a chromatographic column containing water saturated silica gels [210]. A solution of sarin is allowed to pass in diisopropylether through the column, while the impurities indicated are retained and can be eluted with water after the passage of the ether solution containing sarin. The separation of various insecticides thiophosphoric esters, such as paraoxon, parathion, chlorthion and bromthion was achieved by Sandi [203] on a column of hostalene powder (low pressure polyethylene) using cyclohexane as stationary phase from a mixture of ethanol-acetate-buffer as mobile phase. To separate mixtures of different organic acids of phosphorus and their esters the displacement chromatography on cation exchanger columns proved to be suitable [211-212] and a column with anion exchanger Dowex 1-X8 was used along with hydrochloric acid as eluting agent to separate products of hydrolyisis of organo-phosphoric compounds [229].

31.7.2. Paper Chromatography

The general procedure is as follows:

A small amount of solution of the substance is applied at a marked point, the starting point at the lower end of a paper strip; the strip is then suspended with this end in a solvent containing water. The solution or working medium is sucked up by the paper and wanders over the substance spot. According to the distribution between the working medium and the stationary phase, in this case the cellulose moistened with water, the substances wander with different speed. When the working medium front has almost reached the upper end of the paper, the strip is removed from the working medium and the front is marked. If the substances separated themselves are not colored, they must be rendered visible for evaluation by spraying the chromatograms which reagent which give in the reaction with the substances separated a colored product.

The measure for the wandering speed of the substances is the Rf value[11]:

$$\text{Rf value} = \frac{\text{distance between starting point and substance spot}}{\text{distance from starting point to the solvent front}}$$

The Rf value is characteristic for the substance. But its value depends on the working medium, the type of paper and some of the conditions (temperature, saturation of the separation chamber and the paper with the solvent vapor among others) which can not always be kept constant. Therefore it is surer to allow the standard substances to pass on broader chromatograms to whose Rf value we can refer, or to use reference substance

[11] In English: "Ratio" referred to the "front".

Paper chromatography is relatively time consuming; a 40 cm long chromatogram requires according to the type of paper, working medium and development technique (ascending or descending or horizontal technique), between 6 and 20 hours.

21.7.2.1. Organophosphoric Compounds

Paper chromatography is one of the most important methods for the chemical and biochemical investigation of these compounds. From the chromatographic behavior conclusions can be drawn on a structure of these compounds, especially the type of bond of sulfur. When using a polar stationary phase and a nonpolar mobile phase compounds with sulfur in thiono bond (P=S) show the maximum Rf values. Sulfur in thiol bond (P-S-) reduces the Rf values. The substitution of sulfur by oxygen also reduces the Rf values.

Solvent System

Limits are imposed on the normal behavior with water as stationary phase in the application for substances which are hardly soluble in water, because of which for some organophosphoric compounds, the work is carried out with a polar solvent as stationary phase or with reversed phases, that is a nonpolar liquid is used on the paper, such as silicon or mineral oil, and a polar solvent is used as working medium. A survey of some common solvent systems may be found in Table 31.6.

Table 31.6

Organophosphoric Compound	Solvent System	Literature
VX, similar compounds and products of hydrolysis	n-butanol-ethanol-glacial acetic acid-water (8:2:2:3)	[213]
Products of hydrolysis of sarin	I. n-butanol-ethanol-glacial acetic acid-water (8:2:1:3) II. i-butanol-i-propanol-2 mNH4)H	[214]
Parathion and similar compounds	stationary phase: silicon oil mobile phase: water-ethanol-chloroform (6:10:10)	[216, 218]
Parathion, systox and isomeric compounds	stationary phase: mineral oil mobile phase: ethanol-acetone-water (1:1:2)	[217]
Isosystox and products of oxidation	toluene-acetonitrile-methanol-water (8:2:5:5)	[219]

Detection of the Organophosphoric Compounds on the Chromatogram

A generally applicable method of detection according to Hanes and Isherwood [220] is based on the transformation into phosphoromolybdic acid and its reduction to molybdinum blue according to the following procedure:

The dry chromatogram is sprayed with a solution which is prepared by mixing 5 ml 60 percent perchloric acid, 10 ml 1 normal hydrochloric acid and 25 ml 4 percent ammonium molybdate solution and filling with water up to 100 ml. The sprayed chromatogram is heated for 7 minutes at 85 degrees C. If subsequently we allow the action of an atmosphere of hydrogen sulfide or we spray with very dilute hydrochloric tin (II)-chloride solution, the organophosphates are detected as blue spots.

The detection of thiol and thionophosphoric compounds which are difficult to hydrolyze is rendered possible by previous spraying of the chromatogram with a solution of N-bromosuccinimide.

The most sensitive detection for organophosphoryls which inhibit cholineesterase in vitro, takes place through the modified biochemical methods [216]. Many of the methods were established with different substrates; the method with horse blood serum and indoxylacetate is very convenient in its execution [221]. Compounds such as parathion which inhibit only in vivo, are oxidized by treatment of the chromatogram with bromine vapor or spraying with an N-bromosuccinimide solution into in vitro inhibitors. Other suitable spraying reagents for the detection of organophosphoric poisons on paper chromatography may be found in Table 31.7.

31.7.3. Thin Layer Chromatography

The separation takes place in this chromatographic method on thin layers of adsorbers, which are on a suitable solid support, for example glass plates. The principle of separation is then mainly adsorption, but when other layers are used, distribution, ion exchange and gel filtering can also be affected. The advantages of thin layer chromatography are short working time, excellent separation sharpness, high sensitivity and general applicability because of the extensive variability of the stationary phases. The selection of the detection reagents is greater than for paper chromatography, since some aggressive reagents, such as iodine, potassium permanganate, and concentrated sulfuric acid can also be used.

The adsorbers used most frequently are fine-grained silica gel, or aluminum oxide containing a binder (gypsum or starch) and after they have been agitated with water into a paste, they are applied by means of a suitable spreading device into layers about 0.25 mm thick on the supports. The coated plates are dried subsequently. The general procedure in the development of the chromatograms is similar to that described for paper chromatography. Because of the simplicity of the execution the ascending technique is preferred, in which the plates are inserted simply in the mobile phase. With regard to the evaluation through the Rf values the same applied as was indicated in paper chromatography.

In recent years various manufacturers have brought on the market ready made materials for thin layer chromatography. The adsorbers are bound by adding suitable binders (starch, polyvinylalcohol, water glass) on rigid (glass plates) or flexible (aluminum or polyester foil) supports in tear-resistant layers. As compared with the self-coated glass plates, the industrially precoated foils have the advantage that the layers are standardized with regard to their thickness, homogeneity and their chromatographic properties. The flexible supports and the tear resistance of the layer allows the safe transport and storage of large quantities of material, which allows the application of thin layer chromatography in field analysis. Another advantage is that the ready-made foils are inscribed just like paper and can be cut to any format.

The development of chromatographs in the application of DC ready-made foil takes place preferably in the "S-separation chamber". The latter consists of a tubular tank sealed on both sides and provided with a longitudinal slit for receiving the working medium and the separation chamber frame. The frame is a plate provided on three sides with small seating shoulder. Between this frame and a second smooth plate the DC ready-made foil is clamped after applying the substances by means of a clamp and placed through the slit into the tubular tank. The advantage of the S-chamber is the low consumption of solvent even with very rapid saturation of the chamber atmosphere with the solvent vapor.

Possibilities of manifold and new applications for thin layer chromatography may be obtained by combination with the TAS method[12] developed by Stahl [286] and which corresponds basically to the method of air extraction of the warfare agents applied in the field laboratory. Many organic substances are volatile at higher temperature and can be separated thus from the specimen materials and made to undergo chromatography after direct transfer to a DC plate. Figure 31.8 shows the schematic structure of the TAS furnace.

The specimen is placed in a glass cartridge. The cartridge sealed tight at the rear end is placed in a preheated block furnace. The volatile substances evaporate and leave through the capillary opening of the cartridge as a jet of vapor. Directly in front of this opening the DC plate is held on which the volatile substances deposit at starting point and subsequently undergo chromatography. The TAS method was applied among other things already for the separation of alkaloids, herbicides, insecticide organophosphoryls and smoke poisons, including LSD.

31.7.3.1. Separation and Detection of Chemical Warfare Agents

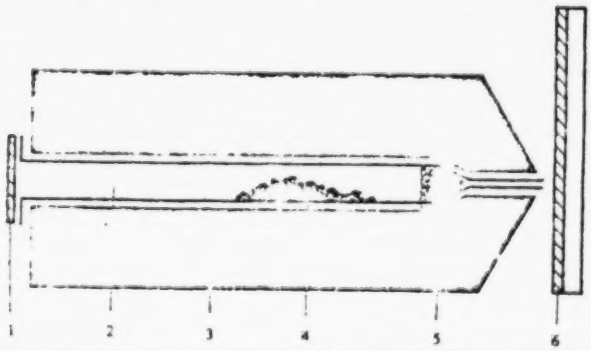


Figure 31.8: TAS Furnace
Key: (1) seal; (2) glass cartridge; (3) heating block (furnace); (4) specimen; (5) glass wall; (6) DC layer.

A working medium system suitable for the separation of DFP, tabun, sarin and soman on silica gel layers is n-hexane-acetone-methylenechloride (7:2:1) [187]. The Rf values of the warfare agents are for DFP 0.5, tabun 0.26, sarin 0.27 and for soman 0.41. A mixture of n-hexane and ethylacetate in the proportions 3:1 and with n-hexane-acetone (4:1) most of the thiolorganophosphoryls can be separated on silica gel layers. To separate organophosphoric warfare agents of the type VX with a tertiary nitrogen atom in the molecule, a small amount of a base, for example diethylamine must be added to the working media in order to prevent retention at the starting point caused by salt formation on the weakly acid silica gel layers. For

[12] TAS = abbreviation for thermomicro-, separating, transfer and application method for substances according to Stahl.

the simultaneous separation of warfare agents of the sarin type such basic working media are not suitable however, since the amines would destroy these agents.

The maximum sensitivity for the detection of the organophosphoric warfare agents on the chromatograms was found in the biochemical methods based on the inhibition of choline and aliesterases.

The procedure with indoxylacetate as substrate offers the advantage that the inhibitor spots can be identified in the UV light as well as in daylight [221].

Spray solutions:

A. Enzyme solution (equal parts of a 10 percent aqueous solution of lyophilized horse blood serum and testal standard buffer of pH 10.10 are mixed).

B. Substrate solution (0.5 percent indoxylacetate are dissolved in a mixture of 2 parts of acetone free from aldehyde and 3 parts ammonia).

Procedure:

The plates taken from the separation chamber are moistened after evaporation of the working medium by spraying uniformly with the enzyme solution and subsequently kept for 10 minutes (for sarin and soman) or 30 minutes (for VX) in a vessel with atmosphere saturated with water vapor. After the incubation period the plates are sprayed with a substrate solution and examined in the light of an ultraviolet lamp. After 1 to 2 minutes the inhibitors are identified as dark spots against a strong bluish-green fluorescent background. With the gradual disappearance of the fluorescence then by the oxidation of air of indoxyl into indigo a blue basic color appears, against which the inhibitor spots appear white. The detection limit is 0.005 µg sarin and soman and 0.05 µg VX. For the exclusive evaluation in ultraviolet light the use of n-methylindoxylacetate is advantageous at substrate [197], since the fluorescence lasts longer. The detection sensitivity is higher in ultraviolet evaluation but when used on extracts of different specimen material disturbances appear more strongly from the contents of the specimens extinguishing fluorescence and extracted at the same time.

More accessible than horse blood serum esterase are aliesterase preparations of cattle liver /196/ so that we will describe their application for the biochemical detection of organophosphoric warfare agents on thin layer chromatograms.

Spray solutions:

A. Enzyme solution (1 part cattle liver is homogenized with 5 parts of water. If no homogenizer is available, the liver cut into small pieces can be crushed thoroughly in the mortar with sea sand and then mixed with water. The homogenisate is centrifuged for 10 minutes at 5000 RPM. The supernatant solution is mixed with testal standard buffer of pH 10.0 in the proportion 1:1 and used as spray solution.

   The homogenisate can be freeze dried under vacuum. The dry preparation obtained retains its activity for years if it is kept cool and protected from humidity. To produce a spray solution 20 mg are dissolved in 10 ml buffer.

B. Substrate solution (20 mg α-naphthylacetate are dissolved in 2 ml acetone free from aldehyde; 6 ml water are added).

C. Coupling reagent (10 mg fast blue salt[13] are dissolved in 8 ml water).

Procedure:

General procedure is similar to the one described in the biochemical detection with ChE and indoxylacetate. After the incubation time the chromatograms are sprayed one after the other with the substrate solution and the coupling reagent. The inhibitor spots are recognizable after a few minutes white against a violet background.

A survey of other spray reagents, especially for the detection of organophosphoric poisons containing sulfur may be found in Table 31.7.

The general detection method described in 31.7.2.1. through the transformation into phosphoromolybdic acid can also be applied to detect organophosphoric poisons on thin layer chromatograms. After spraying the chromatograms are heated for 10 minutes at 110 degrees C.

Yperites

The solvent mixture of chloroform and acetone (5:4) is suitable for the separation of sulfur yperite and its products of hydrolysis on silica gel layers [191].

Sulfur and nitrogen yperites can be detected with high sensitivity on thin layer chromatograms with 4-(p-nitrobenzyl)-pyridine.

Spray solutions /198/:

A. 2 percent solution of 4-(p-nitrobenzyl)-pyridine in acetone.

B. 10 percent solution of ammonium carbonate in a mixture of water and acetone (1:1)

C. 10 percent potassium hydroxide solution in 50 percent ethanol.

Procedure:

After the evaporation of the working medium the chromatogram is sprayed strongly with spray solution A, then slightly with B and subsequently heated for 10 minutes at 110 to 120 degrees C. After cooling it is sprayed with a spray solution C. The yperite as well as the irritant chloracetophenone are visible as blue spots. The detection limit is 1 µg.

Sulfur yperite can be detected on silica gel layers, containing fluoresceine by treatment with bromine vapor. The color of the background is represented by the red tetrabromofluoresceine (eosine) to which the yperite spots, in which the bromine is transformed by oxidation of the yperite into sulfoxide, gives a yellow contrast.

[13] Double zinc salt of tetraazotized o-dianisidine.

In ultraviolet light the yperite spots can be recognized by a yellow fluorescence on a dark background. The detection limit is 5 g sulfur yperite. The layers containing fluoresceine are obtained by agitating the silica gel to coat the plates with water, which contains dissolved 0.04 percent sodium fluoresceine.

Nitrogen yperites can after spraying of the chromatograms with the modified Dragendorff reagent be identified by the orange-red color of the complex compound described in section 28.3.11.

Table 31.7

Poison	Spray Reagent, Procedure, Sensitivity	Literature
DFP, tabun, sarin, soman	5 percent aqueous NaOH containing 1 percent H_2O_2; then dried at 110 degrees C, sprayed with saturated solution of dehydrated $CoCl_2$ in acetone; dry again at 110 degrees C blue spots on white background detection limits: 10 g sarin and soman, 20 µg DFP, 40 µg tabun.	[187]
organophosphoryls containing sulfur (among others VX)	a) 5 percent palladiumchloride in 2 ml hydrochloric acid and 98 ml water →according to the type of sulfur bond yellow (for -S-C, -SO-C and -SO_2-C) to brown (for P S and -SH) spots detection limits: 2-10 µg	[222]
	b) potassiumhexaiodoplatinate 1 g platinumchloride dissolved in 10 ml water and mixed with a solution of 10 g KI mixed in 250 ml water, before it is used it is diluted 1:6 with water. → yellow spots on pink background detection limit: 1 - 5 µg.	[215]
	c) 5 percent NaN_3 in 0.1 N iodine solution → white spots on brown background detection limit: 1 to 10 µg	[223]
organophosphoryls containing sulfur with P S groups	0.5 percent 2,6-dibromo-p-benzoquinone-4-chlorimide in cyclohexanol; heat 5 minutes at 110 degrees C →red spots detection limits: 0.1 to 0.2 µg	[224]
organophosphoryls with tertiary aminonitrogen or a choline group (tabun, VX)	Modified Dragendorff reagent Solution A: 0.85 g basic bismuth nitrate are dissolved in 10 ml glacial acetic acid and 40 ml water Solution B: 8 g potassium iodide are dissolved in 20 ml water. Stock solution: Equal volume parts of solution A and B are mixed. Spray solution: For use 1 ml stock solution is mixed with 2 ml glacial acetic acid and 10 ml water. →orange spots on yellowish background. detection limits: 2 - 5 µg.	[195]

Table 31.7 (continued)

Poison	Spray Reagent, Procedure, Sensitivity	Literature
thiolphosphonates (VX)	0.2 N NaOH in 50 percent ethanol, after a few minutes with 1 percent 5,5'-dithiobis(2-nitrobenzoic acid) in mixture of 1 part ethanol and 1 part 0.45 M tris-buffer of pH 8.2 → yellow spots.	[186]

Other Warfare Agents

Bromobenzylcyanide (CA), chlracetophenone (CN) and 2-chlorobenzylidenemalodinitrile (CS) can be separated on layers of acid aluminum oxide with the mixture of solvents benzol and chloroform (19:1). Benzol-dichloromethane (3:1) is suitable to separate chloracetophenone an 2-chlorobenzylidenmalodinitrile with secondary products on the same layers [188].

The irritating agents indicated are detected by spraying the chromatograms with a 0.5 percent solution of p-benzoquinone in methanol, subsequently if 1:1 diluted ammonium solution through a brown (CN), yellow (CA) or blue (CS) spot [188]. The detection limit is 5 to 10 µg. With the detection system described in 31.7.3.1. with 4-(p-nitrobenzyl)-pyridine CS gives a yellowish-orange, CN gives a blue and CA a reddish violet spot.

Adamsite is detected with a red spot when the chromatograms are sprayed with concentrated sulfuric acid. The same spray reagent is also suitable for the detection of the psychotoxic warfare agent BZ. When the chromatograms are heated to 110 degrees C BZ and the other benzilic esters give carmine red spots.

Potassiumhexaiodoplatinate or a serium sulfate-sulfuric acid reagent (→ red spots) can also be used to detect BZ. The separation takes place on silica gel-G layers with the medium cyclohexane-chloroform-diethylamine (5:4:1) or methanol-ammonia solution (99:1) [189].

LSD and related indole substances can be separated on silica gel G layers with chloroform methanol (9:1) as working medium [231]. The detection takes place in ultraviolet light (360 and 254 nm) by observing the blue fluorescence or by spraying with a modified Van Urk reagent (0.5 g p-dimethylaminobenzaldehyde dissolved in 95 ml ethanol and 5 ml concentrated hydrochloric acid). The reagent indicates the presence of these compounds by a blue-violet color. The detection limit is 0.05 µg LSD [190].

31.7.3.2. Sabotage Poisons and Herbicides

Sodiumfluoracetate can be separated on silica gel G layers with a working medium containing 4 percent ammonia in ethanol. The detection takes place by spraying with alcoholic silver nitrate solution and irradiation with ultraviolet light of wavelength 360 nm. Fluorine acetate is identified up to a detection limit of 0.1 µg by a dark spot [192].

Various chlorinated phenoxylcarbonic acids, such as 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T), 2,4-dichlorophenoxybutyric acid (2-4-DB), 4-chloro-2-methyl-phenoxyacetic acid (MCPA) and α,α-dichloropropionic acid (dalapon) can be separated on layers which consist of 60 percent kieselguhr and 40 percent silica gel with starch as binder. The working medium used is paraffin oil-benzol-glacial acetic acid-cyclohexane (1:3:2:20); the detection takes place by spraying with 0.5 percent alcohol silver nitrate solution and irradiation with ultraviolet light, while brownish-black spots are visible against a white background [230].

After the separation on the ready-made foil silufol UV 254 (the manufacturer is the Cavalir Company, Prague, Czechoslavakia) with the working medium benzol-acetone (40:60) these herbicides can be detected by spraying with a solution of 0.02 percent rhodamine B in ethanol and 5 minutes irradiation with ultraviolet light, which makes them visible as violet spots against a pink background [193].

The detection of the chlorinated phenoxy-fatty acids after the separation on silica gel-G layers by spraying with a reagent which consists of a solution of 4 g sodium salt of chromotropic acid in 40 g water and 56 g sulfuric acid. When the chromatograms are heated to 160 degrees C the herbicides are visible as violet spots against a white background [199].

31.7.3.3. Alkaloids

The working media used are:

Number	Working Medium	Reference Substance	Rf
I	chloroform-acetone-diethylamine (50:40:10)	rhodamine B	0.58
II	chloroform-diethylamine (90:10)	rhodamine B	0.49
III	cyclohexane-chloroform-diethylamine (50:40:10)	rhodamine B	0.20
IV	cyclohexane-diethylamine (90:10)	butter yellow	0.45
V	benzol-ethylacetate-diethylamine (70:20:10)	butter yellow	0.44
VI	chloroform	butter yellow	0.85
VII	cyclohexane-chloroform (30:70) + 3 drops diethylamine	butter yellow	0.85
VIII	methanol	rhodamine B	0.53

The thin layer chromatography allows the systematic analysis of the alkaloids according to a procedure established by Waldi, Schnackerz and Munter [227]. In this connection the alkaloids are subdivided into 2 groups and we establish first through a preliminary testing with the working medium 3 on silica gel G layer which is the group of the unknown substance. The evaluation takes place by examination in the ultraviolet light and by spraying with potassium hexaiodoplatinate reagent. The reference substance used is rhodamine B. Alkaloids with a Rf value below 0.30 are then assigned to

Group I, those with Rf values above 0.30 to Group II. The identification of Group I then takes place besides the evaluation of color reactions by separation with the working media I and II on silica gel layers, those of Group II by separation with the media III, IV and V also on silica gel. In cases of doubt the separation can also be carried out with the media VI, VII, and VIII on aluminum oxide G (D) and alkalized silica gel (instead of water 0.1 normal sodium hydroxide is used to stir in the coating substance). The most favorable amount applied is 50 g substance to be studied.

The evaluation takes place according to Table 31.8.

The separation of a wide spectrum of toxic compounds including among others the alkaloids is possible with a working medium which contains methanol/acetone/triethanolamine (50:50:1.5) on silica gel layers [228]. A previous separation according to the Stas-Otto method is proper.

Table 31.8. Rf Values and Color Reactions of Alkaloids

Layer	K	K	K	K	K	A	A	K (alk.)	Fluorescence Color in Ultraviolet (365 nm)	Color with Iodoplatinate reagent	Form of the Spot	Number of Secondary Spots
Working Medium	I	II	III	IV	V	VI	VII	VIII				
						Group I						
morphine	0.10	0.08	0.00	0.00	0.03	0.03	0.00	0.34	--	deep blue	round	--
atropine	0.38	0.40	0.16	0.05	0.12	0.00	0.10	0.17	--	violet blue	round	--
colchizine	0.47	0.41	0.04	0.00	0.04	0.11	0.00	0.57	--	light gray	round	--
homatropine	0.37	0.45	0.15	0.05	0.23	0.04	0.24	0.15	--	violet blue	round	--
brucine	0.42	0.63	0.18	0.00	0.19	0.50	0.54	0.12	--	violet brown	round	1
strychnine	0.53	0.76	0.28	0.05	0.38	0.57	0.60	0.22	--	yellow	drawn	--
						Group II						
physostigmine	0.65	0.90	0.32	0.04	0.44	0.59	0.50	0.46	--	pink	round	1
aconitine	0.68	0.90	0.35	0.03	0.49	0.36	0.60	0.65	--	reddish brown	round	3
emetin	0.67	0.90	0.40	0.06	0.45	0.38	0.58	0.50	blue	reddish brown	round	3
papaverine	0.67	0.90	0.42	0.03	0.47	0.85	0.84	0.70	yellowish	yellow	round	--
narcotine	0.72	0.90	0.51	0.10	0.57	0.81	0.79	0.72	blue	light yellow	round	--
cocaine	0.73	0.90	0.65	0.36	0.58	0.84	0.77	0.62	--	violet	round	--

K = silica gel; A = aluminum oxide; K (alk) = alkaline silica gel

31.7.4 Gas Chromatography

Gas chromatography is one of the latest chromatographic techniques but over the two decades which have elapsed since the beginning of its whirlwind development, it has

become one of the most important methods of organic and chemical analysis and new areas of application are constantly being open to it. Its special advantage as compared with the previously discussed chromatographic methods is the possibility of recording the separation possible to record simultaneously by a simple method the separation process both qualitatively and quantitatively. Gas chromatography is similar to column chromatography, but instead of the liquid medium a gaseous mobile phase is used, the carrier or extracting gas. The area of application is thus fixed for gaseous substances or specimens which can evaporated without destruction, but characteristic volatile products of pyrolysis can also be separated by gas chromatography and information obtained on the composition of the specimens. The gas or vapor specimen is fed to the carrier gas current; the latter passes through a tube which can be tempered and is filled with a stationary phase. The stationary phase used is a solid adsorber such as silica gel or active carbon or a liquid of low vapor pressure which is placed on an inert, porous carrier material. Besides the filled columns recently capillary columns have been used which have capillaries with an internal diameter of 0.2 to 0.5 mm, but are up to 150 m long, on whose internal wall a liquid film forms the stationary phase. The separating effect of these capillary columns is extremely high; we may expect theoretically 100,000 to 500,000 plates, since a good distillation column has about 100 theoretical plates. Using short capillary columns, extremely short times of analysis are reached which often amount to only fractions of a second; naturally the cost of the equipment is really high.

The indication of the components appearing after passing through the separation columns at intervals in the carrier gas current is carried out with detectors which are mostly based on physical principles such as measurement of thermal conductivity and gas density, flame and radiation ionization, or mass spectrometry and whose indication is registered with an automatic recorder. Recording curves are obtained with a number of tips (peaks) expressing the number of components, and whose distances from a starting point represent the retention times important for the qualitative evaluation. The peak areas are used for quantitative evaluation.

Gas chromatography allows the analysis of complicated mixtures in a fraction of the time needed for the ordinary methods and is one of the most sensitive methods to detect and determine toxic substances.

31.7.4.1. Organophosphoric Compounds

Whereas silicone oils and high vacuum fats are used very generally as stationary phases and rough-grained kieselguhr (chromosorb) as carrier material, the use of gas chromatography for separating and determining organophosphoric compounds led to some very interesting new developments for detectors.

Of the ordinary detectors, the thermal conductivity measurement cell and the flame ionization detectors are suitable for indicating the organophosphoric compound. For the very sensitive detection of compounds with high electron affinity, including the insecticides and herbicides containing chlorine and various toxic insecticides, organophosphoric compounds, a modification of the radiation ionization detector, the so-called electron accumulation or electron catcher detector has assumed great importance.

Through the beta irradiation of a tritium source the molecules of the nitrogen used as carrier gas are ionized, free electrons are formed which under the effect of a fixed

potential applied to the detector cell wander to the anode acting as measurement electrode and give a stable outlet current. If electron accumulating molecules occur in the specimen substance, negative ions are formed which move more slowly in the electrical field and almost all combine with positive ions before they reach the anode. The ionization currents measured initially with the pure carrier gas is reduced by an amount proportional to the number of the negative ions formed per unity of time. Up to a certain level there is proportionality between the signal of this type of detector and the product of the concentration and electron accumulation capacity of the compound. The different incorporation capacities measurable with the electron accumulation detector is suitable for identifying unknown compounds. The average sensitivity of the detector for organophosphoric compounds is in the nanogram range.

An arrangement in which the compounds contained in the carrier gas current after passage through the separating column is burned in a quartz tube in an oxygen current or reduced by hydrogen at high temperatures is widely used to determine chlorine, sulfur, and phosphorus compounds; the reaction products are then determined continuously in a coulometric titration cell. As compared with the electron catcher detectors in these the method has a lower sensitivity, but the indication is element-specific and is less subject to disturbances by other organic compounds. It is therefore very suitable to determine organophosphoryls in the most different specimen materials. Concentrations of 25 to 50 ng/l water could be determined in association with a method of extraction according to this technique [233].

The specific indication of phosphoric compounds at higher sensitivity is allowed with the sodium thermionic detector which was described for the first time in 1964 by L. Giuffrida [234]. It consists of a wire coil drawn with a sodium soil, which is placed directly over the normal hydrogen-flame ionization detector. The salt heated by the flame gives an ionic current which in the passage of organic halogen and phosphorus compounds is greatly amplified by the detector.

This arrangement was improved subsequently several times and in the modern variants of this detector the wire coil drawn with alkaline salt is replaced by a pierced salt tip placed on the burner of the flame ionization detector and which is produced as compressed cesium bromide or rubidium sulfate. Organophosphoric compounds are detected with this detector in picogram (10-12 g), compounds containing chlorine in the nanogram (10-9 g) amounts.

A high specificity of the indication is achieved by combination of gas chromatography with emission spectrometry. In the upper part of the hydrogen flame of the flame ionization detector the intensity of the emission bands of phosphorus (256 nm) and sulfur (394 nm) present in the passage of poison is measured with a sensitive photometer. The detection limit is 10 ng parathion.

It is apparent from the above short description of the individual types of detectors, that the development tends toward an increase in specificity of the indication. The method of gas chromatography is specifically the most universal method of separation of complicated gas mixtures, but the qualitative characterization of the components with the highly sensitive detectors but with nonspecific indications raises considerable difficulties and is mostly possible only by comparison with standard substances. Since on the other hand the technique of mass spectrometry allows the exact identification of

organic compounds with extraordinarily low amount of specimen, but the direct analysis of a complex mixture of unknown components by this method raises almost insoluble problems, the logical consequence of the previous development was to combine the gas chromatographic separation with mass spectrometric identification. Since with amounts of specimen of only 10-8 to 10-10 g it is possible to obtain mass spectra which can still be interpreted, the detection limit achievable by combining the gas chromatograph with mass spectrometer is in order of magnitude in the range of indication of the sensitive flame ionization detector. The combination can be obtained both directly for the continuous operation and discontinuously, by collecting the components separated in the gas chromatograph individually in the adsorption tube and later undergoing desorption in a mass spectrometer. Since for this procedure the spatial separation of gas chromatograph and mass spectrometer is possible, it was possible to examine centrally specimens from different laboratories with a mass spectrometer of particularly high quality.

To study the organophosphoric compounds of high boiling points which can be evaporated without destruction, it is possible to use the products of pyrolysis, the alkyliodides after carrying out the Zeisel alkoxyl reaction, the methylester after treating with diazomethane or especially for systox and similar compounds, the volatile thioether after hydrolysis with alkalides or alcoholates. The combination of thin layer chromatography with gas chromatography allows the separation of mixtures of substances containing components which cannot be distilled.

Examples of the application of the gas chromatography method for organophosphoric poisons are the separation obtained by Verweli et al of diastereoisomeric O-alkylmethyl fluorophosphonates and similar pyrophosphonic esters and the direct conversion of soman with antidotes followed by Okonek [237] by means of gas chromatography. This author used a glass column 1.5 m long with a diameter of 2 mm, which was filled with 5 percent SE-30 (silicone) and 5 percent QF-1 (fluoralkylsilicone) on chromosorb W-AW-DMCS (kieselguhr washed with acid and treated with dimethylchlorsilane) 100/120 mesh. The temperature of the column was 130 degrees C, the indications of the soman was obtained with an alkali thermionic detector.

31.7.4.2. Other Warfare Agents and Poisons

Sulfur yperite and its product of hydrolysis were separated in a column of 1.5 meters length which was filled with 3 percent cyclohexanedimethanolsuccinate on gas-chromium Q (100/120 mesh) at a column temperature of 120 degrees. The indication was achieved with a flame ionization detector, while in the case of sulfur yperite a linear relation was established between the amount of specimen and the peak area up to 50 g yperite /238/.

The indication of sulfur yperite is more specific with a flame photometric detector which measures by means of a suitable filter the intensity of the emission band of sulfur at 394 nm. The gas chromatographic separation takes place with 4 percent FFAP on chromosorb W AW-DMCS (60 to 80 mesh) for a column temperature of 155 degrees C. When adding 1 g specimen solution, the limiting concentration is 2 by 10-4 mg/ml and the calibration curve is linear in the region of 1 to 120 µg/ml [322].

Bromobenzylcyanide (CA), 2-chlorobenzilidenemalonodinitrile (CS) and chloracetophenone (CN) were separated on 10 percent QF-1 on gas chromium Q (60/80 mesh) in a column of 1.5 m length at temperatures of 65 to 200 degrees C. With the thermal conductivity detector it is possible to indicate amounts in the milligram range, with the flame ionization detector microgram and with the electron catcher detector levels in the nanogram range. The limiting concentrations achievable with the electron catcher detector for the study of contaminated air were 0.4 mg CA/m3, 0.02 mg CN/m3 and 0.01 mg CS/m3 /239/.

The determination of phosgene in the air up to a limiting concentration of 1 by 10-4 mg/l can be obtained by gas chromatographic separation and indication with the electron catcher detector /235/.

A glass column 0.80 long filled with 0.25 percent SE-30 microglass pearls is suitable for the separation of LSD. The temperature of the column should be 255 degrees C; the indication is accomplished with a flame ionization detector /240/.

The gas chromatographic separation of the chlorinated phenoxyacetic acid herbicides is possible after treatment of the extracts with diazomethane while the volatile methylesters are formed /312/. The extractions of these herbicides takes place at pH 2.0 by extraction with benzol or chloroform. While 1 liter of the specimen is treated successively with 80, 50, 30, 30 ml solvent. The yield is 35 to 80 percent for concentrations of 1 mg/l, 70 to 100 percent for concentrations above 5 ml/l /313/. Picloran is extracted from soil and plant samples with potassium hydroxide, converted after acidulation into ethylacetate and is also converted by treatment with diazomethane into the methylester volatile without destruction. The latter is determined by gas chromatography on 2.5 percent neopentylglycoladipate on silanized chromosorb W (80 to 100 mesh) with nitrogen as carrier gas at 185 degrees C using an electron catcher detector /314/. Picloran can be extracted from water and soil samples after the acidulation with acetone. 2 µl of the extract are decarboxylized in a pyrolysis section connected in front of the separation column at 385 degrees C into 4-amino-2, 3,5-trichloropyridine. The gas chromatographic separation of the reaction product takes place at 165 degrees C on a column 105 cm long with 3 percent SE-30 of chromosorb W (60-80 mesh) with a subsequent column 60 cm long with 10 percent DC-200 on gas chromium Q (60-80 mesh). The carrier gas used is nitrogen (10 ml/min); the indication is obtained with an electron catcher detector. In water specimens 5 by 10-4 to 10-1 mg/l can be detected, in salt specimens, 5 by 10-2 to 1 mg/kg /315/. The gas chromatographic separation of the bromacil extracted from plant, soil and water specimens takes place at 200 degrees C with 3 percent QF-1 fluorsilicone and 2 percent DC-200 silicone on gas chromium Q (80-100 mesh). The carrier gas used is nitrogen (30 l/min); the indication is obtained with the electron catcher detector /316/.

The separation and enrichment of 2,4-D and 2,4,5-T from water can be achieved very elegantly and quantitatively by means of a tube filled with the adsorber resin XAD-2 (divinylstyrol polymer) at pH 2.0. The dimensions of the adsorption tube are 10 by 60 mm; after the passage of 2 l water drying is carried out with a nitrogen current and subsequently the herbicides are eluted with 20 ml acetone. For the esterification 1 ml of the elute is treated with 1 ml of a 14 percent solution of boron trifluoride at 80 degrees C. After adding 5 ml water the ester is extracted with 10 ml cyclohexane. 2 µl of the extract are sprayed into the gas chromatograph. The separation takes place

on a 1 mm glass column with 2 percent OV-225 on chromosorb W-HP (100-120 mesh) at 190 degrees C. The carrier gas used is argon with 5 percent methane (50 ml/min); the indication is accomplished with an electron catcher detector. With this procedure 0.025 mg/l can still be determined [304].

Monuron and diuron are saponified in the extracts with 20 percent sodium hydroxide into the corresponding substituted anilines. The determination is achieved with temperature program gas chromatography on 100 by 0.6 cm column with 20 percent apiezone fat L on chromosorb W (60-80 mesh). The initial temperature is 75 degrees C, the rate of increase 8.8 degrees C/min. The carrier gas is helium (50 ml/min). 4-chloraniline emerges from the column at 180 degrees C, 3,4-dichloraniline at 212 degrees C. The indication is achieved with a flame ionization detector [321].

31.8. Electrochemical Methods

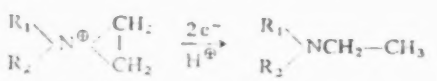
The polarographic methods with which sensitive determinations and kinetic investigations are possible and which are suitable for combination with a separation method, such as column or gas chromatography are of particular interest. Other electrochemical methods, such as potentiometric titration are indicated each time in the description of the chemical, biochemical or elementary analysis study of the warfare agents.

31.8.1. Polarographic Methods

Since in general only such ions or molecules of the polarographic determination are accessible which can be reduced or oxidized on an electrode under electron catcher or release, limits are imposed on the application of this electrochemical method to organic compounds. Some warfare agents however are accessible to polarographic determination.

Sulfur yperite is polarographically inactive against the mercury drop electrode, but for a potential of +0.9 V against the saturated calomel electrode on the rotating platinum electrode, with which we must work in this voltage range it is oxidized and can be determined quantitatively from the stage height. In the studies on catalytic waves by which we mean the catalytic shift of the hydrogen separation to a lower potential by polarographically otherwise inactive substances, Brdicka established that sulfur yperite in the presence of ammonia cobalt chloride solutions also shows this effect. This observed catalytical effect is not attributed to the sulfur yperite itself but to a reaction product with ammonia. Of the possible compounds among others, β-aminomethylmercaptane was studied polarographically and proved to be catalytically effective [207]. The quantitative determination of sulfur yperite is possible by measuring the catalytical waves following the cobalt stage.

The nitrogen yperites are polarographically inactive, but the quarternary nitrogen can be reduced polarographically in the intermediary ethyleneimonium ion formed in the hydrolysis by cyclization, while the following mechanism was postulated [208].



The polarographic method is therefore very suitable for the kinetic study of the conversion of nitrogen yperite into ethyleimonium compounds. The detection and determination of warfare agents containing arsenic, such as diphenylchloro- and cyanoarsine, adamsite and α-lewisite are possible both with the classical polarography with mercury electrode and with the oscillographic polarography [209]; in the latter, these warfare agents can be differentiated qualitatively by the different position of the sections on the two branches of the oscillogram. The application of the classical polarigraphy to the determination of the organophosphoric compound is limited, apart from the indirect methods to those which contain reduceable functional groups such as paraoxon and parathion, or in the hydrolytic separation of polarographically active products. The latter include malathion, in which the fumaric acid is measured and systox and tinox, which can be determined by measuring the catalytical hydrogen waves which are produced by the hydrolytically formed thiol groups. An important advance was achieved by oscillographic polarography with which the organophosphoryls which are inactive in classical polarography can be detected and determined with high sensitivity.

Check Questions

1. How can an unknown substance be identified by determining the melting point?

2. What is the importance of the index of refraction for characterization of organic compounds?

3. How can the infrared spectroscopy be used for the detection and determination of organophosphoric warfare agents?

4. What chromatographic methods are suitable in particular for analysis of warfare agents? Compare the methods with each other.

5. Define the Rf value and explain its importance.

6. How are biochemical methods used for the detection of the organophosphoric warfare agents by chromatography?

7. Compare the gas chromatography with regard to advantages and drawbacks with other chromatographic methods.

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SCIENTIFIC RESEARCH IN ANTARCTIC DESCRIBED

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[Article by Krzysztof Birkenmajer: "The Fifth Antarctic Expedition of the Polish Academy of Sciences at the H. Arctowski Station"]

[Text] The tasks of the Fifth PAN [Polish Academy of Sciences] Scientific Expedition at the Henryk Arctowski Antarctic Station, located on King George Island in the South Shetland Archipelago (West Antarctic), was to:

--complete the research and organizational cycle of the 1976-1980 5-year plan, MR.II.16: "The Integrated Investigation of the Antarctic and Arctic as a Basis To Protect and Examine Their Natural Environments;"

--initiate new investigations for the new 1981-1985 5-year cycle, MR.II.16: "Investigating the Sea and Land Polar Regions as a Basis for the Rational Use of Their Resources and the Protection of Their Environment."

The PAN Institute of Ecology, located in Dziekanow Lesny near Warsaw, organized the expedition. The administration consisted of four people: Prof Dr Eng Krzysztof Birkenmajer, expedition director; Eng Lech Rosciszewski, deputy director for general affairs (subsequently designated director of the winter group); Eng Maciej Zawadzki, deputy director for technical affairs; and Eng Karol Teliga, director of the winter group (during the expedition's organizational phase in Poland). In Poland, preparations for the expedition took about 1 year, from the fall of 1979 to the fall of 1980.

Twenty people from the summer group and 20 people from the winter group (24 people from the scientific team and 16 people from the technical team) were supposed to be included in the expedition. However, because it was necessary to reduce expedition expenditures significantly, only 24 expedition participants, including 5 people from the winter group, sailed from Szczecin on 27 November 1980 to the Arctowski Station on the first voyage of the M/S "Zulawy," a Transocean PPURM [expansion unknown] transport-supply ship commanded by Navy Captain Leon Skelnik.

The remaining member of the Fifth Expedition winter group were supposed to sail to the Arctowski Station in mid-March 1981 on a ship which in its return voyage to Poland was supposed to pick up the summer group. However, in view

of the unsuccessful attempt to evacuate some of the Fourth Expedition winter group with the aid of the fishing ship M/T Levanter during the last quarter of 1980, the entire Fifth Expedition winter group was included in the expanded Fifth expedition summer group up to the beginning of February 1981 when the S/Y "Poria," chartered by the Institute of Ecology and commanded by Navy Capt Krzysztof Baranowski, arrived at the Arctowski Station. Two members of the Fifth Expedition winter group arrived on this yatch and eight participants of the previous winter expedition (Fourth) departed on it.

Five foreigners (two from the FRG and three from the United States) also participated in the summer expedition.

Organizational Scheme of the Summer Expedition

As a result of the repeated changes in the personnel status of the Fifth Expedition mentioned above, a total of 51 people participated in the Fifth Expedition during the 1980-1981 Antarctic summer season, of which 7 remained for the winter together with 12 people who arrived at the Station on 23 March 1981 on the training-cargo ship M/S "Antoni Garnuszewski," commanded by Navy Capt T. Draczkowski.

During the summer expedition to the Arctowski Station (8 January 1981 - 27 March 1981), all station personnel were directed by a three-member management team consisting of Prof Dr K. Birkenmajer, director; Eng L. Rosciszewski, deputy director for organizational affairs; and Eng M. Rzepecki, deputy director for technical affairs. The expedition was divided into six groups of which five were scientific groups having appropriate directors and whom in essence, operated independently:

I. The Geological Photography Group: Prof K. Berkenmajer (director), W. Danowski and Eng K. Rolnicki;

II. The Sedimentology-Paleontology Group: Prof R. Gradzinski (director), Dr A. Gazdzicki, Dr S. Porebski and Dr R. Wrona;

III. The Geophysics Group: A. Szymanski (director), Eng T. Radomyski, Eng J. Komorowski (up to 5 February 1981, he sailed on the "Pogoria") and J. Weiss;

IV. The Meteorology-Oceanographic Group: Eng E. Moczydlowski (director up to 5 February 1981, he sailed on the "Pogoria"), Z. Rawa (director from 5 February 1981), Eng A. Maciazek, Eng G. Marczak and R. Marks;

V. The Biology Group: Prof E. Kolakowski (director), R. Gutkowski (to 5 February 1981, he departed on the "Pogoria"), Dr R. Halba (to 5 February 1981, he departed on the "Pogoria"), Dr S. Misiaszek, he arrived on the "Pogoria"), Dr Med W. Schramm (J. w.) [expansion unknown], Dr W. Trivelpiece (United States, from 12 February to 2 March 1981), Dr N. Volkman (j.w.), Dr R. Butler (j.w.);

VI. The Technical Group directed by Eng L. Rosciszewski, consisted of three separate teams:

VIA (the aviation team): Eng J. Grzybowski (director), Pilot E. Bienaszewicz, Pilot W. Kurzynski, Mechanic Z. Musialski and Mechanic Z. Sygit;

VIB (the maritime team): Eng M. Rzepecki (director), A. Cieslak (fisherman, cutter service), J. Kaminski (mechanic), J. Kaszubowski (PTS [expansion unknown] amphibian service up to 5 February 1981, he departed on the "Pogoria"), H. Nowak (radio operator), Eng P. Majewski (power engineer) and L. Wisniewski (PTS amphibian service);

VIC (the technical team): K. Potrzebowski (director), C. Augustyn (cook), J. Berendowski (radio operator), W. Chudzynski (electrician to 5 February 1981, he departed on the "Pogoria"), J. Krasakiewicz (mechanic), Dr Med W. Nurkiewicz (doctor), J. Styczynski (mechanic), J. Szylak-Szydlowski (Radio operator to 5 February 1981, he departed on the "Pogoria").

Expedition Program

The Scope of Scientific Work. During the Fifth Expedition the scientific research program stipulated work on all three subproblems of the MR.II.16 (currently MR.I.29) plan for the 1981-1985 period, that is: (A) the biological sciences, (B) the earth sciences and (C) oceanography. Because the primary biology program of the 1980-1981 Antarctic summer season was supposed to be realized by a separate sea expedition organized by the PAN and the Fishing Institute in the framework of the international FIBEX (BIOMASS) program on the ship R/V "Professor Siedlecki," it was projected that research at the Arctowski Station would not be as extensive as in previous years. However, research in the earth sciences--geology, paleontology and applied geophysics, especially with the aid of helicopters, was supposed to be intensified and expanded.

Personnel from the following institutions realized the Fifth Expedition scientific program: the PAN Institute of Ecology, the PAN Institute of Geological Sciences, the PAN Institute of Geophysics, the PAN Department of Oceanography, the PAN Department of Paleobiology, the PAN Institute of Parisitology, the Institute of Meteorology and Water Management, the Szczecin Agricultural Academy, Warsaw University and the Military Institute of Aviation Medicine.

The following problems were included among the main research projects:

--regional examinations of the geological structure of the South Shetland Archipelago using surface geology methods including various-scale photographs; stratographic, tectonic, sedimentological, paleontologic and paleoecologic investigations as well as exploratory geophysical methods (profile photographs using a proton magnetometer) using helicopters as a source of transportation and aerial reconnaissance. The more distant surrounding areas of the Arctowski Station were stipulated as the primary areas, that is the remaining and still uninvestigated areas of King George Island, Nelson Island and the western extremes of Livingston Island (Byers Peninsula).

The goal of these investigations was to examine the geological structure of the South Shetland Archipelago as a basis for drawing conclusions concerning the geological structure of the Antarctic shelf and the possibility of mineral resources;

--further examinations of the biological environment of Admiral Bay's water region on King George Island using biological (including parasitological), biochemical and oceanographic methods as well as investigations of its water region fringes (hydrochemical, biological and other methods), at times using air transport. Investigations encompassing the water regions of Admiral Bay were supposed to be done with the aid of research cutters. It was projected that special attention would be paid to problems associated with the functioning of the Antarctic's biological system, with special attention to investigating the processes of the flow of materials in the land-sea system. In addition, investigations on the possibility of obtaining nutritive protein from krill (Euphausia Superba) were stipulated;

--stationary geophysical (magnetism and seismology) and meteorological observations (in the latter case as a WMO meteorological shield and weather service;

--protecting the environment of the H. Arctowski Station: the effect of the Station's activities on the land and sea environment, the durability of the building materials and construction used there, the extent of accumulated contaminations and the like;

--the effect of this environment on the human organism.

The Scope of Technical work. The technical problems associated with the specific of the ground operations of the 1980-1981 summer expedition required the use of helicopters (then located at the Station) to transport the ground groups, especially the earth sciences and biology groups. Two Polish-made Mi-2 helicopters were used, which have been used successfully during the Third Expedition to the Arctowski Station (1978-1979). The plan called for the establishment of an auxiliary fuel base for the helicopters on Greenwich Island in Yankee Harbor Bay and then its elimination at the end of the summer season with the aid of the expedition ships. A expedition ship was supposed to try to land the sedimentological-paleontological ground group on Livingston Island, which was supposed to remain there about 1 month and then was flown via helicopter to the Arctowski Station. An alternative solution in case it was impossible to land on Livingston Island by ship because of poor weather and ice conditions and undesirable landing spots was to transport the group from the Arctowski Station to Livingston Island via two helicopters operating simultaneously.

In view of the reconstruction of the Arctowski Station during the Second and Third expeditions, no significant investments were planned except the building of a new magnetic pavillion. The expedition's technical operations plan stipulated mainly technical examinations, repairs, improving existing stationary and mobile equipment, certain adaptations and so forth.

The Scope of International Cooperation. Working and official visits to the scientific stations of King George Island were stipulated, that is to the Bellinghausen Station (USSR), the Presidente Frei Station (Chile) and Teniente Jubany Station (Argentina) using the expedition's helicopters. On the return trip to Poland, a visit to the Argentine and Chilean stations on Antarctic Peninsula to discuss conditions for closer cooperation in coming years was stipulated.

A Calendar of the More Important Events During the Expedition

1. The departure of the Fifth Expedition from Szczecin on 27 November 1980: 24 participants (including five from the winter group) aboard the M/S "Zulawy."

2. South Georgia (Gold Harbor), 22-28 December 1980: provisioning Polish fishing ships. Tests of expedition floating equipment (rubber pontoons and slips) along the M/S "Zulawy"'s mooring itinerary--the South Georgia coast (Gold Harbor).

3. East Falkland (Port William), 30 December 1980-5 January 1981. Provisioning Polish fishing ships. Tests of expedition (j.w.) floating equipment along the itinerary: mooring of the M/S "Zulawy" (Port William)--Port Stanley and other places on the island.

4. The arrival of the Fifth Expedition at Admiral Bay (King George Island), at the H. Arctowski Station, 8 January 1981 at 5:50. The transport of people and equipment to the Station completed 11 January 1981 at 08:00.

5. An attempt to land on Livingston Island (Byers Peninsula) the sedimentology-paleontology group (four people) together with a landing group from the M/S "Zulawy." A sudden worsening of the weather (wind and snow storms) which lasted 2 days forced termination of the operation and the return of the ship to the Arctowski Station (11-12 January 1981). The M/S "Zulawy" departed 12 January 1981 at 20:30 on a fishing trip.

6. Research and organizational-technical activity of the Fifth Expedition in the South Shelland region based at the Arctowski Station, 13 January to 23 March 1981: ground operations of the geology, geophysics and biology groups started 14 January;

--using a helicopter, ground operations of the named groups started 18 January and ended 15 March 1981. As a result of an engine failure on one of the helicopters (the lack of an engine cooling shield that was dismounted mistakenly by the aviation group together with the failed engine during the Third Expedition in 1979) it was not possible to use both helicopters simultaneously. That is why I was forced to cancel the planned geological-paleontologic research on Livingston Island because of flight safety on such a long journey; as a result, research work on King George and Nelson Islands was intensified.

7. From 27-29 January 1981, the Arctowski Station hosted the following ships of the FIBEX (BIOMASS) international research program: "Walter Herwis" (FRG), "Odysej" (USSR) and "Itzuma" (Chile) as well as the oceanographic ship "Meteor" (FRG). I made the Station available as a location for the FIBEX participants and participants of the oceanographic expedition from the ship "Meteor" visited the station.

8. From 4-7 February 1981 the S/Y "Pogoria" visited Arctowski Station, br nging two members of the Fifth Expedition's winter group and taking to Poland eight members of the Fourth Expedition's winter team.

9. On 7 and 16 March and from 21-24 March 1981 the Polish ship R/V "Professor Siedlecki" visited Admiral Bay's water regions, executing its program in the FIBEX framework. Its management and expedition participants visited the Station and for several days four of them worked at the Arctowski Station using its facilities and floating equipment.

10. The Arctowski Station also hosted the following research ships: "Yelcho" (Chile) on 24 January 1981 and "Hero" (United States) on 12 February and 16 March 1981 as well as the tourist ships: "World Discoverer" on 14 and 28 January 1981 and "Linblad Explorer" on 23 January and 4 February 1981; all in all about 600 foreign tourists visited the Station.

11. Official and working visits to the King George Island stations:

--Bellinghausen (USSR): 28-29 January 1981--five participants of the Fifth Expedition together with the management as well as two foreign guests (FRG), an exploratory visit; 19-24 February--four participants of the sedimentology-paleontology group visit the Soviet station doing research on the Fildes Peninsula; 19 February--the director of the Bellinghausen Station and three coleagues visited Arctowski Station; during March there were many working visits, including the delivery of spare parts for land vehicles at Bellinghausen Station, the familiarization of our participants with transferring fuel to the tank located at this station and so forth. All contacts occurred with the aid of Polish helicopters;

--Presidente Frei-Teniente Marsh (Chile): 20 January 1981--two Chilean helicopters visited the station management and last winter's crew (taking leave) and the new management together with 26 people; 28-29 January--another Polish visit to the Chilean station (our helicopter); 14 February--transported guests from the FRG to an airplane taking off for America using our helicopter; 19-24 February--a visit from our sedimentology-paleontology group living at the Bellinghausen Station, part of the Chilean station group; 4 March--the director of the Chilean station (O'Higgins Station) on the Antarctic Peninsula visited the Arctowski Station. In addition, using our helicopter, assistance was provided in retrieving a pontoon washed up by waves on the shore south of the Chilean station;

--Teniente Jubany (Argentina): 23 January 1981--an exploratory visit from us and help by Polish specialists in repairing heating equipment at the Argentine station; 28 January--transported food via our helicopters from the Teniente Jubany Station to the Argentine land base on Ardley Island; 28-29 January--four Argentine biologists revisited the Polish station, transported via our helicopter. In addition, there were many working visits during February and March to the Argentine station in conjunction with Polish land operations in its surrounding areas.

12. Return trip on 23 March 1981 at 10:00 to Admiral Bay by the expedition ship M/S "Antoni Garnuszewski". Twelve participants in the winter group visited Arctowski Station, bringing the number of winter group personnel to 19. The return trip of people, equipment, supplies and so forth lasted to 27 March. The winter group of the Fifth Expedition (including a part of the winter group of the Fourth Expedition), a total of 31 people, plus 19 people from the FIBEX Expedition embarked from the R/V "Professor Siedlecki."

13. On 28 March 1981 at 1:00 the M/S "Antoni Garnuszewski," commanded by Navy Capt Tadeusz Draczkowski, left Admiral Bay on the return trip to Poland. On the way it stopped at Cabedo, Brazil, (8-10 April) to take on cargo and in Las Palmas, Canary Islands (April 18). The expedition ended in Gdynia on 27 April 1981.

Main Results of the Scientific Research

Regional Geology (Professor K. Birkenmajer and team). Using a helicopter as a source of transport and at times with the aid of a research cutter, geological photographs on a 1:50,000 scale were taken of those portions of King George Island that were still unexplored, namely the area between Penguin Island and Cape Melville and farther on toward the north around North Foreland and then the entire north area of the island's shore between North Foreland and Fildes Peninsula together with numerous islets, and finally the entire Maxwell Bay region along with the eastern part of Nelson Island. The 1:50,000 scale geological photographs taken during the Fifth Expedition were of areas that measured over 1000 km^2.

In addition several very detailed maps were drawn up of selected areas, for example, Cape Melville, Potter Peninsula and Barton Peninsula. Extensive sea fauna were discovered, probably of the Cretaceous age, in a pulpy sedimentary series on Cape Melville which to date has been considered mistakenly by British researchers as quaternary lava and tuff. The occurrence of traces of the Antarctic continent's glaciation in this complex has been ascertained.

The stratography, tectonics, volcanic forms and metallic mineralization of King George and Nelson Islands mesozoic and kainozoic complex were examined, and the large pass faults between these islands were thoroughly investigated. The history of the quaternary age, dormant volcano Melville Peak was developed.

Over 100 orientated samples of lava were collected for petrographic, geochemical and radiometric research.

Sedimentology (Professor R. Gradzinski, Dr S. Porebski). The sedimentological environment of the tertiary marine-galcial deposits of the Pliocene Polonaise glaciation between Lions Rump and Low Head (King George Island) was investigated, and detailed sedimentological studies were made of the tertiary land-derived deposits on Fildes Peninsula. In addition the volcano-derived agglomerates on Fildes Peninsula and around Arctowski Station were investigated as well as the gravely beach deposits at Admiral Bay. The group used a helicopter for transportation.

Paleontology (Dr A. Gazdzicki, Dr R. Wrona and at times with the help of Professor K. Birkenmajer's group). An extensive selection of Pliocene marine invertebrates from the region between Admiral Bay and King George Bay was collected, also a large selection of marine invertebrates and several remains of vertebrates, probably from Cretaceous deposits of the Cape Melville region. Detail paleoecological studies were conducted in both regions.

The remains of fossil flora (leaves, kernels and wood) of the tertiary period continued to be collected in the Fildes Peninsula region, on Potter Peninsula, in Ezcurr Bay and at Point Hennequin on Admiral Bay.

Deserving special attention is the collection of erratic Cambrian period limestone from remains of coral-shaped Archaeocyathi derived from sea-glacial and continent-glacial deposits on King George Island brought in during the glaciation period by drifting ice mountains and glaciers from within the Antarctic continent. The group used a helicopter for transportation.

Geophysics. (A. Szymanski and team). Measurements were taken with a proton magnetometer of the glacial and shore profiles between Ezcurr Bay and Bransfield Straights. In the modeling region, south of Arctowski Station, detailed profiling using a proton magnetometer were based on precise geodetic matrices (T. Radomyski).

A new magnetic station was placed into service in the reconstructed pavillion; stationary magnetic measurements and magnetic recording were conducted regularly (A. Szymanski, Eng J. Komorowski) as well as seismic recording (J. Weiss). During the construction of the magnetic pavillion and during operations on the glacial area a helicopter was used.

Oceanography. (R. Marks). Systematic observations of the emission and dissemination of marine-origin aerosol was conducted; aerosol samples were collected and then analyzed microscopically and chemically; in addition, experimental investigations of the flow of aerosol mass per unit area was conducted. The measuring mast and test console were installed near the Arctowski Station lighthouse.

Meteorology. Meteorological observations were conducted continuously in the WMO world system according to the program for a highest order station which were transmitted daily to the Bellinghausen and President Frei Stations (Z. Rawa, Eng A. Maciazek). Satellite pictures were taken and analyzed, developing prognoses for helicopter flights, the R/V "Professor Siedlecki," ships of the Fifth Expedition and the Polish fishing fleet operating in the South Georgia and Falkland areas, and also for those foreign ships requesting it (for example, the FIBEX program, tourist ships) (Eng G. Marczak).

Biometeorology (Eng E. Moczydlowski). Stationary investigations from the previous season were continued at automatic measurement stations in the penguin colony near Arctowski Station. With the arrival of the earth sciences group, investigations were also conducted at forward positions in colonies of breeding penguins between Maxwell Bay and Cape Melville.

Hydrology and Biochemistry (Dr W. Lawacz, Dr S. Misiaszek). Since mid-February 1981 measurements of organic carbon content, salinity, oxygen content and temperature changes were initiated in the lakes surrounding Arctowski Station using 10 posts.

Ornithology. With the use of helicopter flights, research was expanded on the location and numbers of birds on King George Island. In this way, ornithological investigations of the entire island during the breeding season were

executed, which to date has not been possible. Of the 54 penguin colonies recorded during the Fifth Expedition, only 9 were known previously, several of them described decades ago and which were not visited by anyone since that time; this creates an exceptional opportunity for comparative research (Dr B. Jablonski). In addition, research continued on the dynamics of the growth of nestlings of selected petrel species (Fr A. Wasilewski) and investigating the population and ringing selected bird colonies (Dr W. Trivelpiece, Dr N. Volkman and Dr R. Butler, United States).

Mammology (Dr R. Halba). With the aid of a helicopter, changes in the seal population were investigated in the wide areas surrounding Admiral Bay, and biological material was collected to investigate environmental pollution. Additional chemical tests were conducted on samples collected last year. After Dr R. Halba departed on the "Pogoria," Dr B. Jablonski continued investigating the pinnipedian population of the entire King George Island area using helicopter flights with the geological photography group.

Botany. Up to 5 February 1981, photosynthesis and deep breathing processes of selected species of marine algae were investigated (R. Gutkowski). The primitive production of selected species of marine algae was investigated, ascertaining the high photosynthesis content, and samples were collected for further biochemical analyses (Dr R. Dawson and Dr W. Schramm, the FRG). A collection of moss and lichen was gathered from all the sites visited by the ornithological group (Dr B. Jablonski) during the helicopter flights with the geological photography group.

Krill Research (Professor E. Kolakonowski, Dr K. Lachowicz). Investigations were conducted on the technological usefullness of fresh krill (Euphausia superba) to obtain edible protein via the cold autoprotolysis method patented in Poland. It was shown that unfrozen krill can be successfully processed via this method into protein precipitate and concentrate that are free of solid carapace parts. The conditions for the production of edible concentrated protein obtained from krill were determined. Samples were prepared for further detailed tests in Poland.

Engineering and Environmental Protection. Sensing devices were mounted on the fuel tank's external jacket; an anemometer and a device to measure tank deformation during winter were installed (Eng L. Rosciszewski). Soil samples were collected using the shallow geological-engineering drilling method (W. Danowski, Eng K. Rolnicki) to evaluate the geotechnical conditions of Arctowski Station. Area-elevation photographs of the fuel tank region were taken (Eng T. Radomyski).

International Cooperation

As in past years, during the Fifth Expedition Arctowski Station maintained regular communication with the Soviet Bellinghausen station and the Chilean station, Presidente Frei, transmitting daily weather reports to the WMO system. Cooperation with these two stations as well as with the Argentine station Teniente Jubany also included mutual assistance and exchange of experiences in technical problems as well as the exchange of scientific personnel. In the framework of the scientific personnel exchange, four members of our expedition's

sedimentological-paleontological group lived for 5 days at the Soviet station conducting scientific research on the Fildes Peninsula, and four Argentine biologists stayed 2 days at the Arctowski Station. Two FRG biologists, Dr R. Dawson and Dr W. Schramm, spent 19 days with the Fifth Expedition. They conducted research in the area of primary production of marine algae. Three American ornithologists--Dr W. Trivelpiece, Dr N. Volkman and Dr R. Butler--spent 3 weeks with the expedition continuing their research of the 1977-1978 period.

Arctowski Station was the site of a working conference organized by Prof G. Hempel (FRG) during the visit (27-29 January 1981) of ships of the FIBEX sea expedition. Taking advantage of the presence of Prof Dr Meischner, University of Gottigen geologists, who directed the marine-geological program on the ship R/V "Meteor," a program on the geology of the sea of the South Shetland region was discussed. During the same time, in the course of a visit to the Presidente Frei station, the principles of Polish-Chilean geological cooperation in the field of radiometric dating of tertiary and Mezozoic lava of King George Island was discussed with Prof F. Herve of Santiago, Chile.

Arctowski Station also hosted other representatives of science, especially from the National Science Foundation and Office of Polar Programs (Washington, DC), including Doctor Williams (present director of biological programs); Dr G. Llano (previous director of biological programs); A. F. Betzel (director of oceanographic programs); Professor Dearborne (zoologist); Prof M. D. Turner (director of earth sciences programs); and Prof I. W. D. Dalziel, well-known Anartic geologists from Lamont Geological Observatory (Columbia University). The Fifth Expedition's director organized a geological trip to the area around Arctowski Station for the latter two scientists.

Close cooperation developed traditionally with the research and tourist ships that visited Arctowski Station. At the request of their captains, Arctowski Station transmitted to these ships weather-icing conditions in the sector from Bellinghausen Sea through Drake Strait to the Sea of Weddell based on satellite pictures taken by our own WESSA equipment. Ships of the Polish fishing fleet in the South Georgia and Falkland regions, ships of the M/S "Zulawy," S/Y "Pogoria" and M/S "Antoni Garnuszewski" expeditions in the course of their journeys through Antarctic waters, and the research ship R/V "Professor Siedlecki" and other FIBEX program ships received analogous information on a regular basis.

Most Important Scientific Accomplishments

Among the most important technical accomplishments of the Fifth Expedition worthy of mention is the construction of a new magnetic pavillion at the Arctowski Station, at times with the help of a helicopter which was used to transport building material. The biological laboratory was also expanded by one segment.

As is done every year, inspections and maintenance were executed, and adaptations to Station installations, to the radio station, heavy equipment and so forth were accomplished. About 140 helicopter flights were completed, a total

of over 80 flight hours. The damaged helicopter engine was changed two times. The research cutter "Dziunia" was inspected and repaired; the cutter "Slon" was launched and prepared for operation. Several dozen trips were made on Admiral Bay, primarily by the "Dziunia," to fish for krill, to transport cargo and to safeguard the underwater operations of FIBEX expedition frogmen (Doc K. Jazdzewski and team). The Gryf pontoons were operated (during the expedition as well as for transport and research purposes) on Admiral Bay and previously during the layover of the expedition ship M/S "Zulawy" near South Georgia (18 landings) and near East Falkland (32 landings).

PTS amphibians were used to unload the M/S "Zulawy" at the Arctowski Station (about 200 tons) and the reloading of the M/S Antoni Garnuszewski". Together with the research cutter and pontoons, they were used to fill the "Siedlecki" with 100 tons of drinkable water from the Itslian Valley water intake (Ezcurr Bay) and the "Pogoria" with 40 tons of drinkable water and 18 tons of fuel.

Sanitary Care and BHP [Industrial Safety and Hygiene]

Medical care was provided by Dr Med W. Nurkiewicz and Dr Med J. Rozynski, the Fourth Expedition winter group doctors who stayed over for the entire Fifth Expedition period. Dr Rozynski also continued the research program of the Fourth Expedition winter group up to the arrival of the "Pogoria"; he also conducted daily control preflight tests of the helicopter pilots.

During the Fifth Expedition, despite many land operations by the research groups, frequently working 30-40 kilometers from Arctowski Station, no accident occurred requiring hospitalization or major surgery. Mountain-glacial, station, marine, aviation, fire-fighting and other BHP instructions were developed and vigorously observed, and appropriate rescue services were trained at the Station. Contact with Arctowski Station's radio center was ensured by continuous monitoring during all helicopter flights and each time any floating unit went to sea. Flight logs, sea-journey logs and mountain-glacial journey logs beyond the Station area were kept daily. Ground groups had established times to contact the Station's radio center.

All expedition participants received detailed training in BHP during the course in Mikolajek (September 1980) as well as during the journey aboard the M/S "Zulawy" and landings at South Georgia and East Falkland and finally during the trips at Arctowski Station as well as at the Station itself and its surrounding area.

In several cases, the Fifth Expedition's medical service also provided general medical and dental aid to passengers and crews of tourist ships visiting Arctowski Station.

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RECENT SCIENTIFIC DEVELOPMENTS DESCRIBED

Laser Development, Production

Zielona Gora GAZETA LUBUSKA in Polish 31 Aug 82 p 7

[Article by (brj): "A Laser Produced in Zielona Gora? By All Means!"]

[Text] Light Amplification by Stimulated Emission of Radiation--this is an apparatus which amplifies microwaves of light by means of the stimulated emission of radiation. This apparatus has diverse applications, not excluding the military. With the aid of the laser, complicated eye operations and precision surgical cutting are conducted. Recently the Americans have been conducting research on constructing a laser device to combat an enemy's missiles.

Before such a complicated apparatus is produced, however, studies are continuing in the scientific laboratories on the laser's applications. Future scientists and practical workers must also acquaint themselves with the essential operation of this apparatus. It is for them specifically that simple lasers of modest capacities are being produced. I do not think that too many readers are aware that they are being made in Zielona Gora.

The plant producing the lasers is located on Fabryczna St and is called the Center for Research and Development on Research and Teaching Apparatus (COBRABID). It is precisely here, in adapted warehouse rooms, that a modest-sized team, under conditions which are almost hutlike, is making lasers which are intended for the science laboratories of higher schools. For several years a small portion of the amount produced has been earmarked for export. That means on order from the Kanuer Firm from West Berlin, from the materials entrusted to them, finishes lasers intended for spectral research studies. Similar lasers, with capacities of 6 milliwatts, are being produced for Poland itself.

In addition to this production COBRABID is also making tension recorders and digital integrators. At present the 40-person team is aiming to make static-pressure sensors. It is a well-known fact that the reform has compelled us to seek out new types of production. For there is a lack of parts which were never purchased for the devices. Therefore, production has had to

be discontinued on apparatus which relies on imported subsets. New products have to be introduced in its place.

The plant's production is not large, amounting to 12 million zlotys in toto. There is apprehension that this will decline. People are leaving because, in addition to the fact that the work here requires a great deal of knowledge and precision of execution, the pay is not the best.

But what does the laser look like? It is a long tube, filled with a helium-neon mixture, which, thanks to the appropriate apparatus, begins to radiate. The radiation is amplified and directed. For this purpose a whole system of various devices are attached which for a humanist are extremely complicated, though for a technical person they are very simple. And it is already possible to carry out research with the use of the laser. One can also perform various "miracles" such as holography, or the creation of three-dimensional images. At COBRABID they say that this is possible even in Zielona Gora.

New Economic Sciences Institute

Warsaw ZYCIE GOSPODARCZE in Polish No 33, 5 Sep 82 p 2

[Article: "The INE Is in Operation"]

[Text] In 1981 a new scientific outpost of the PAN [Polish Academy of Sciences] was appointed with a location in Warsaw--the INE [Institute of Economic Sciences], which began operating on a wide scale during the year 1982.

The institute conducts scientific-research work in the following fields:

--economic theory, particularly the political economic theory of socialism;

--analysis, forecasting, and strategic studies of Poland's socioeconomic development;

--fundamental systematic-institutional solutions for the functioning of a socialist economy;

--economic integration of the socialist countries;

--developmental trends of the world economy;

--contemporary directions in the development of economic thought and economic research studies on an international scale.

The INE has been assigned the following tasks, among others:

--development of theoretical thought in support of Poland's experience, that of the other socialist countries, as well as worldwide practice;

--linking together in scientific-research works economic aspects with sociological, political-science, ethical, cybernetic, and other aspects;

--improvement of scientific personnel;

--propagandizing Polish scientific thought and Polish practices on an international scale.

These tasks are being implemented at the institute's plants and scientific laboratories. A Scientific Council will begin functioning in the very near future. The institute is cooperating with other institutes and scientific outposts within Poland and abroad.

The INE's directorship is being handled by a PAN member Prof Dr Hab Jozef Pajestka. The deputy directors are Prof Dr Hab Janusz Gorski and Prof Dr Hab Witold Trzeciakowski, while the scientific secretary is Prof Dr Hab Barbara Pradecka.

The address of the INE is as follows: 00-901 Warsaw, Palace of Culture and Science, pok 2215, tel 20-86-95, as well as 00-441, Warsaw, Newelska St 6, tel 36-63-81.

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END

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East Europe Report

SCIENTIFIC AFFAIRS

No. 760

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EAST EUROPE REPORT
SCIENTIFIC AFFAIRS

No. 760

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BRIEFS

SOLAR COLLECTORS FOR FODDER DRYING--PRAGUE, 6 Oct--Seventy-thousand square metres of solar collectors should be available for water heating and 20,000 for fodder drying in Czechoslovakia in 1985. Due to increasing lack of classic energy resources solar energy is planned to be used as a complementary energy source shortly. For example, in 1985 solar energy and heat pumps should replace 66,000 tonnes of standard fuel and in 1990 already 175,000 tonnes. The average useable solar energy on most of Czechoslovak territory is 970 to 1,130 kwh per square metre annually. In some regions, for example, in southern Moravia and south-east Slovakia, 1,270 kwh per square metre are available. [Rangoon THE WORKING PEOPLE'S DAILY in English 8 Oct 82 p 2]

CSO: 2020/1

NATIONAL CONFERENCE ON AUTOMATED TECHNICAL PLANNING

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 82 p 2

[Unsigned article: "First National Conference on Automated Technical Planning," to be continued]

[Text] The conference, which was accompanied by extraordinarily great interest, was held between 22 and 26 March by the MTA [Hungarian Academy of Sciences] SZTAKI [Computer Technology and Automation Research Institute] with the cooperation of a number of scientific associations and the OMFB [National Technical Development Committee].

It is nearly 10 years since experts dealing with AMT [computer aided design] problems (the English abbreviation is CAD) have been active in a coordinated way in our homeland. Despite the serious difficulties in obtaining tools, significant research, development and applications results have been achieved and the theme continues to be followed with special interest.

The sections of the conference dealt with electronic and electrotechnical problems (6 sections), machine industry problems (6 sections), construction industry problems (4 sections), technological installation design problems (3 sections), educational problems, problems in applying the finite element method and general device and methodological problems of CAD.

The number of papers read was over 150.

The opening address was given by Tibor Vamos, director of the SZTAKI. He emphasized the timeliness and significance of the conference. He said that the organizers, in the interest of swift arrangements, had abandoned prior publication of the papers and would recommend publication in the professional press on the basis of merit.

The plenary presentations on opening day were given before 150-200 participants.

The chairman's opening address was given by Antal Jantner, deputy minister of the ÉVM [Ministry of Construction and Urban Development] and chairman of the CAD work committee of the Computer Technology Applications Council, with the title "The Status and Tasks of CAD." He noted that as the scientific-technological revolution

accelerated the development of products and technological processes there was a swift increase in variety. Products and technological processes must be replaced more quickly, which increases the work connected with preparation. This phenomenon makes it necessary to increasingly include computer design methods in technical planning in order to ensure the economicalness, utility and marketability of manufactures and products. He spoke about the possibility of using methods based on comparison of several alternatives or on exact optimization and about the significance of technical-economic data banks.

Concerning construction industry CAD he said, among other things: "We are trying to introduce CAD in the construction industry in the interest of the following goals: Developing and spreading construction industrialization including modular construction, developing housing and communal construction, improving the technical planning level of maintenance construction, making planning work better organized, improving efficiency and reducing costs, better utilization of intellectual (engineers') work, making alternative planning general, improving the quality of structures, reducing construction and operating costs (energy needs), and better design preparation for finishing work. In sum, increasing the efficiency of investments.

Computer aided technical design is being developed within the framework of the computer technology target program of the EVM, with the partial support and guidance thereof.

"The target program is more than 10 years old. In the course of its activity it strives to define the guidance of both hardware and software development.

"The branch was backward at the beginning of the Fourth 5-Year Plan. But by 1975 the available equipment had increased from 4 computers to 34. In addition to the central Siemens computer investment the EGSZI [Institute of Construction Management and Organization] began development of a branch network based on ESZR [Uniform Computer Technology System] machines and the planning enterprises got small computers of the VT and TPA [stored program data processing] type and desk, programmable electronic computers (EMG and COMPUCORP).

"The branch computer network based on the ESZR was built up during the Fifth 5-Year Plan (with four provincial regional centers). The central Siemens machine was expanded and it became possible to begin dialog mode applications, via a multi-terminal system, among the planning enterprises. Equipping provincial planning enterprises, primarily, with small TPA computers continued.

"By the end of the plan period there were 110 computers in operation in the area of the branch, counting micro, mini and small computers."

The deputy minister had the following to say, inter alia, about the goals of the Sixth 5-Year Plan in the area of construction industry CAD: "In the area of computer aided technical design we must gradually make general the interactive design methods." Within the framework of the target program they have prescribed the following concrete program developments, and have begun to work them out:

Display of two or three dimensional figures on automatic drawing boards and screens, development of interactive engineering work positions, computer aided systems for panel construction systems, computer aided design systems for prefabricated reinforced concrete construction systems, computer aided planning of water supply and sewerage for housing developments, development of computer aided cell variant planning methods for housing and communal buildings, developing computer data banks of standardized structures, computer program systems for statics and strength measurements, and computer programs for building mechanics and physics measurements.

In his plenary address titled: "Domestic CAD Work, Its Coordination and International Cooperation," Janos Somlo, a main department chief at the MTA SZTAKI, reported on the efforts made in the area of coordinating domestic work and cooperation projects with socialist countries on the basis of an agreement between the MTA and the OMFB, under the leadership of Gyorgy Paris and, later, the speaker. The section breakdown of the conference also reflects that the most significant activity has been conducted in the area of the machine industry, construction industry and electronics. The speaker emphasized the merits of Arpad Csurgay, Gyorgy Gardos, Laszlo Fauszt, Jozsef Hatvany, Matyas Horvath, Gyula Pati and Tamas Roska in domestic CAD work.

He emphasized that, in his opinion, clear ideas about the role and methods of computerized design in the coming decades developed relatively early in our homeland, at the beginning of the 1970's. This was clearly reflected by the studies of the OMFB and the SZATI (Computer Technology Office) dealing with this theme, which played a significant role in coordinating the work. The speaker said that the shortage of tools is significant, many commercial questions await solution, there is a shortage of adequate knowledge, experience and experts and how to encourage work and transmit and receive results has not been worked out.

Despite the spread of ESZR and MSZR [Minicomputer System] devices adequate exploitation of the gigantic potential possibilities of socialist international cooperation is held back by the significant differences in the area of the device base, by the shortage of interactive, graphic devices, by obstacles of an administrative character to the transmission and reception of achievements and by the unsolved nature of incentive and economic questions.

In conclusion, he said that he considers the development of domestic professional culture to be one of the greatest merits of coordinated CAD activity. It is certain, looking to the future, that CAD systems will spread in instruction.

Among the activities in other areas one might mention the IDMS program system acquisition started at the initiative of CAD, the significance of which goes beyond the CAD frameworks. A new initiative is the acquisition of a program package realizing the ASKA finite element method.

A number of partial results have been achieved in the area of the machine industry, among which we might mention the integrated technological planning system; its principles are outstanding and it makes excellent use of the achievements of socialist cooperation. In connection with the CAD achievements of the construction industry the speaker called attention to what had been said in the address by Antal Jantner.

The electronics CAD achievements are outstanding. The AUTER [automatic design] system developed through the cooperation of a number of enterprises and institutes (TKI [Telecommunications Research Institute], SZTAKI, KFKI [Central Physics Research Institute], SZKI [Computer Technology Coordination Institute], HIKI [Signal Technology Industry Research Institute], MIKI [Instrument Industry Research Institute], and BME [Technical University of Budapest]) will be installed in five industrial enterprises in the current 5-year plan, making possible the practical testing of research and development results and the solution of planning and design tasks appearing in great numbers in industry.

Jozsef Hatvany, scientific consultant for the SZTAKI, reviewed the development of CAD devices and applications spreading with extraordinary speed throughout the world. A certain polarization can be observed; on the one hand there are large systems combining increasingly more complex tasks and on the other hand there is a trend toward ever cheaper small systems, largely of the "key transmission" type. The results achieved in the areas of modern operating systems, high level programming languages, new data base management systems, networks and computer graphics have made the development and application of CAD many times more efficient. Systems serving the designer and using artificial intelligence research indicate the path of the future. At the same time we must be careful of demanding always the newest and greatest performance; here also engineering decisions must seek technical-economic compromises.

Arpad Csurgay gave a talk entitled "Modeling and Algorithmizing Problems in Product Development." Starting from an analysis of the process of product development he introduced a ramified system of models and algorithms for automated technical design. The person developing the product must have adequate information about the factory in which the developed product will be produced. From the viewpoint of the designer the factory can be modeled well with the TGE (planned-manufacturing-control) system model, knowing the chief phases of the design process can be formalized. Planning itself is a series of intuitive and algorithmizable "transformations" which produce full documentation for manufacture and control step by step from the specifications. Building on the disciplines of some special area it is possible for the designer [line missing from original], probably: "to develop an infinite number of articles"] from a finite number of models and algorithms. This requires that the models of the article to be designed and the designing algorithms should "develop" in the course of the planning process so that the article can be described in ever greater detail while ever more complex models preserve the information content of the simpler models.

The speaker showed, using the example of a design process for electronic circuits, how the processing of models and algorithms, independent of computer and of technology, fitting standardized design procedures to concrete technologies and with a data base processing of the TGE system model leads to the development of portable design systems making use of the advantages of ever more developed hardware and software environments.

Without trying to be complete, we can report the following about the section papers.

There were papers on the following themes in the area of electronic-electrotechnical CAD applications: the AUTER system and its industrial introduction, electronic planning methods and designing systems, electrotechnical design, filter design, and interactive graphics in electronic design.

Considering that since the end of the 1960's there have been CAD sections (with "mechanical design methods" and at similar titles) a number of domestic conferences in the electronics area (the great majority of the papers dealt with this) we will emphasize the new aspects here.

Following wide-scale industrial installation (the AUTER system) and use the speakers began to include experts using enterprise CAD systems in a creative way and developing them further and the electrotechnical applications, forced into the background earlier, came to the fore also.

Let us first note representative presentations from these two areas. They well reflect the role and effect in applications of the TGE model discussed in the earlier reported plenary lecture (Arpad Csurgay).

The three largest enterprise electronics design systems are the AUTER MPC systems of the EMG [Electronic Measuring Instruments Factory], TERTA and the BHG [Beloiannisz Signal Technology Factory]. Four papers reported on the achievements of the collectives actively using them (Zoltan K. Szabo; Pal Geza Nagy and Antal Kovacs; Janos Horvath; and K. Istvan Gyalai, Gyorgy Mihalyi, Andras Estok and Erno Pracser). The first system installed, at the EMG, already works in two shifts and the enterprise TGE process is based on it. The AUTER MPC system is a turnkey system based on a TPA 1140 computer (supplied with graphic machines, digitalizers, etc.) aiding the design and documentation of electronic equipment assembled on printed sheets. It was developed as part of the target task with the designation SZKCP [Computer Technology Central Target Program] CF22 within the framework of the AUTER program (Imre Abos and Ferenc Bati described the system).

It is worthy of note that the integration of a designing system in the life of an enterprise brings great changes in the technology of enterprise development and that a number of enterprises have installed the same designing system (these also serve as background machines for each other). They also automatically solved the standardization of product documentation for these enterprises.

In a comprehensive lecture in the electrotechnical section Mihaly Szaniszlo talked about an integrated adaptive planning system for electric networks and new control technology systems, making special mention of the place and role of the CAD system.

The many valuable papers also showed that in the course of enterprise introductions on the basis of the achievements of the past 5-year plan there had been a breakthrough in mass use, and many collectives are working on the solution of various practical tasks.

The extraordinary activity of the participants in the sessions of the electronic and electrotechnical CAD section was outstanding. The exchange of information between those dealing with immediate scientific themes and the users of various applications systems was significant. Filter design was characteristic of the first group and lectures and debates by AUTER users were characteristic of the second.

The professional debates and dialogs "swept away" the crowded program and "enchanted" the participants making use of the rare opportunity.

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SPECIFICATIONS OF ORION-KFKI ADP 2052 DISPLAY TERMINAL

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul Aug 82 p 7

[Article by Dr Istvan Lang and Dr Laszlo Tamas Sandor, KFKI [Central Physics Research Institute]: "The Most Extensively Used--The Alphanumeric," continuation of a series on CRT displays]

[Excerpt] The other chief group consists of terminals used in systems made up of small computers, primarily for business purposes, in small computer configurations. Characteristic examples are the VT52 and VT100 alphanumeric displays of the Digital Equipment Corporation. Displays corresponding to these terminals are already manufactured in our homeland also. One terminal type is the Videoton VDT 52100 display terminal family and the other is the Orion-KFKI ADP 2052 universal display terminal. Since industrial series manufacture of the latter has only just begun and its parameters may be less known we will briefly summarize its construction and services.

The Orion-KFKI ADP 2052 Universal Display Terminal

Use of the most developed achievements of highly integrated semiconductor technology (LSI) made possible the development of the universal display terminal. The terminal, which contains microprocessor, RAM and PROM memory also contains a programmable screen control.

When realizing a given screen specification this design not only makes it possible to manage the communications protocol of the terminal with a program but also to use a program to set the desired screen format (number of lines and characters, etc.). This means that one can create different display terminal specifications with the same hardware design (by exchanging the burned-in operating programs, or firmware). This is favorable for both the manufacturer and the user. The manufacturer can standardize the manufacture of displays with different specifications and it is advantageous for the user because if he needs a display with different specifications he need only exchange the firmware in the apparatus.

At present there are versions satisfying the DEC VT52 and VT100 specifications.

Thus the universal display terminal is suitable for the realization of various display specifications.

The universal display terminal is a modern information input and output device from the viewpoint of the linked computer. As compared to the usual screen display specifications it has the following additional possibilities and services.

Supplementary Keyboard

In addition to the normal alphanumeric keyboard one can find, in a separate group, a supplementary keyboard consisting of 19 keys which, on the one hand, facilitates the swift, error-free input of numeric data and cursor movement and, on the other hand, generates, in the so-called functional mode, a special series, "message sequences," which can be interpreted in a manner determined by the user and are used to produce relatively complex, programmed sequences of activities.

Picture Content Preservation Mode

With this operational mode the operator can control the speed of receiving data from the computer and the speed of transmitting data. If the screen is filled an additional line of new information can come in only if the operator permits it by pushing the SC (scroll) key. In a manner similar to the above the writing or display of a full screen of new information can be authorized by pushing the PG (page) key.

Preparing Copy

A line printer can be connected to the terminal. The screen contents can be printed on it line by line or in their entirety.

Graphic Mode

In the graphic mode it is possible to display 32 symbols determined by the user. This helps to display graphs, tables and process diagrams.

Technical Data of the ADP 2052

Display format: 24 lines, 80 characters per line. Character matrix: 6 x 8 raster points. Character assortment: 96 ASCII characters (upper and lower case letters, numbers, punctuation) plus 32 user defined symbols in the graphic mode. Keyboard: an alphanumeric keyboard consisting of 62 keys and a space bar to produce the entire 7 bit ASCII character series, an operational mode control keyboard consisting of 10 keys and a functional keyboard consisting of 19 keys for cursor movement, supplementary numeric data input or control in the functional mode. Cursor: movable in four directions, can be tabbed, can "jump" to a desired position, flashing, and non-destructive underlining (does not hinder display of character). Monitor: an Orion DME-028/AT type, 28 centimeter diameter, green CRT (power--220 V, 50 Hz, 25 VA). Communication: serial asynchronous transmission in accordance with the V.24 prescription, full duplex transmission, transmission speed can be set at 75, 110, 150, 300, 600, 1,200, 2,400, 4,800 or 9,600 baud.

Line printer which can be connected directly: a DZM-180 matrix printer with a speed of 180 characters per second; printing of graphic elements can be changed by exchanging the EPROM; power--220 V, 50 Hz, 80 VA.

NEW ROBOTRON MICROCOMPUTER SYSTEM

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 82 p 7

[Article by Egon Hoffmann: "New Robotron Microcomputer System"]

[Text] In recent years Robotron has developed and manufactured a series of microcomputers or microcomputer systems which are used in distributed systems, as office computers, basic computers, data collection systems, word processors, or programmable terminals in various areas of the economy.

Application Examples

Control of numeric machine tools; to control shelf servicing devices in warehouses; to control chemical industry gas chromatographs; automatic surface water control; industrial robots; control of induction smelting furnaces and 500 MW power plant blocks; ticket punchers and dialog automats in transportation; building material weighing and dispensing equipment; and on-board computers for urban railways.

In addition to the K 1510 microcomputer they are manufacturing primarily the K 1520 (8 bit) and K 1600 (16 bit) microcomputers. They are manufacturing large numbers of the latter with 64 K byte and 256 K byte storage capacity.

In 1981 they produced 12,500 of the K 1520 types alone.

Operation of the Robotron 238 Multitask Microcomputer

If some problem cannot be solved with a single microcomputer then one can use specially developed hardware, or a larger capacity and more expensive computer, or several microcomputers. The last possibility can be used advantageously if the task to be solved can be broken down into many tasks which can be performed in parallel. Examples of this are a patient care (supervision) system in health affairs or the auditing, control and management of complex equipment or processes.

The Robotron 238 multitask microcomputer has an addressable area of 1 M bytes built from the 8 bit microprocessor switching current family and RAMs of 32 bytes per processor. This is an OEM unit which was developed for the realization of especially complex multitask microcomputer configurations, where connection via a universal bus proves most useful.

Connection of functional modules via a universal bus is internationally recognized.

The advantages of the Robotron 238 for system organization, testing and debugging are:

--a real multi-computer organization can be realized;

--every single (SBC) processor can access the entire addressable area (1 M byte) and can operate as both processor and as I/O processor; its operating mode can be changed dynamically;

--it has all functions necessary for handling resources and for process synchronization, which are usually missing in ordinary microcomputers;

--the floppy disk unit makes possible swift and reliable loading of software components;

--a special error correction code applied to the floppy disk guarantees correction of burst errors to a length of 128 bits;

--the system also accepts a soft sector formalized disk, and ensures convertibility of them;

--it has built-in protection devices for error recognition, parity check, memory protection and time control;

--special diagnostic states and a comparison stop mode can be set for program testing. This takes place in the SBC with an appropriate reduction of data transmission speed, without influencing the real time relationship on the universal bus;

--a separate microcomputer serves as bus control for control of the bus processes, automatic error handling and the maintenance system.

These devices ensure that one need not use auxiliary devices as a logical analyzer to test user programs, or use in-circuit emulation and other similar complex external auxiliary devices in developmental systems.

The maintenance system of the Robotron 238 carries out the following essential functions in order to do this: displaying (printing) and changing memory and register contents; control of the comparison stop mode; starting and stopping programs; checking, copying and converting diskettes; and starting tests for the system and for external equipment.

An entire series of diagnostic routines are available to test hardware, as well as test programs for signal checks.

The maintenance system is handled with the aid of keyboard and screen, which ensures convenience. Operating guides can be queried directly with the aid of the Help function.

In the event of a more serious hardware problem the diagnostic routines can be initiated with a plug-in diagnostistic adapter.

Functional Modules

The Robotron 238 multitask microcomputer system is constructed in the following functional modules on 390 x 270 mm circuit panels:

One Single Board Computer (SEC): a complete microcomputer with CPU (U 880), I/O units (1CTC, 1 SIO, 3 PIO), storage units (4 K byte PROM, 32 K byte RAM), RAM dual access (its own CPU and the universal bus), parity check, memory protection, a comparison stop mode unit, and control and error condition registers accessible by program.

Four Standard Interface Adapters (SIFAD)

These make possible connection to the usual computers via an ESZR or IBM standard interface with the following devices: its own microprogram control; simultaneous control of a maximum of eight device functions with four different command series; connection possibilities to byte multiplex, block multiplex or selector channels; connection devices for debugging via software and hardware diagnosis.

Available as supplementary building element groups are: keyboard, maintenance panel, daily clock (adapted to the site), floppy disk drive unit adapter, printer adapter, screen monitor, current supply and assembly accessory.

The software and documentation include: diagnosis routines, a maintenance system, a real time monitor system, a floppy disk access system, hardware description, a programmer's handbook and complete error localization documentation, which locates faulty components with signal analysis.

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SEMICONDUCTOR STORE FOR TELE JS REMOTE DATA PROCESSOR

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 82 p 7

[Article by Janos Mikcsak: "Semiconductor Store for TELE JS Remote Data Processing Processor"]

[Text] It is well known that the remote processing processors of Polish manufacture are delivered with a ferrite ring operating store. The modularly constructed unit can have a maximum of 256 K bytes made up of two 128 K byte blocks. The first 128 K bytes and complementary power units are placed in the processor cabinet. An expansion cabinet is needed for the additional 128 K byte block. Further modularity within the 128 K byte unit ensures very good organizing ability. The unit is made up of exchangeable 16 K byte cards and in event of failure can be made operational again within minutes.

The processor connected to the SZAMALK [Computer Technology Applications Enterprise] ES 1055 computer had a capacity of 48 K bytes. This capacity was amply sufficient for the EP/JS emulator program (which emulated an IBM 270X multiplexor), one of the service programs used. But the network control NCP/JS program needed a minimum of 48 K bytes or more storage capacity.

We had to increase the size of the ES 8371.01 operating store.

One way to realize the expansion would have been to buy additional 16 K byte ferrite cards. Because of the very high acquisition price we were forced to disregard this solution. The other route was to study the possibility of using domestic semiconductor stores made for the ESZR [Uniform Computer Technology System] series 1 computers. We found that, due to the modular similarity and the availability of a power supply, a simple processor store interface made possible the realization of the maximal semiconductor store in the processor cabinet in the place of the ferrite store. We asked the experts of the NIM [Ministry of Heavy Industry] IGUSZI [Institute of Industrial Economy and Business Organization] to make a 256 K byte semiconductor store based on the OL-603 semiconductor store elements developed by them earlier.

The new store consists of sixteen 16 K byte cards and two adapter cards. They used 4 K bit static RAM circuits as the storage element. The unit is placed in a standard rack drawer and can be fitted in the place of the ferrite block

with a screw. Installation is simple. The connector of the processor store interface cable connects from the old store to the semiconductor store, and 5 V power is supplied with some sort of stabilizer. We had to have an additional address line to address the second 128 K bytes, but this could be done with the unused line of the existing interface cable.

Installation and alignment of the prototype took 2 x 4 hours and it has been operating faultlessly since December 1981. The built-in test routines can be used for checking without change.

The advantages of the equipment are low energy and small space requirements (leaving out the expansion cabinet), great reliability, simple and convenient organizing ability and, last but not least, the cheap price.

After coming to an agreement with the manufacturer it will be possible to provide our domestic users with 8,371 remote data processing processors supplied with semiconductor stores.

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EXPERIENCE WITH THE ES 1055 IN ONE YEAR OF USE

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul Aug 82 pp 10-11

[Article by Mrs Endre Selenyi: "The First Domestic ES 1055 Is One Year Old"]

[Text] Putting into operation and handing over the SZAMALK [Computer Technology Applications Enterprise] ES 1055 computer system was completed on 2 February 1981.

The computer system, based on a quite confined but very modern central unit, began work in two shifts. The goal of the first 2 months' work was an exchange of experiences with or on-the-job training of operating experts, already prepared in theory but hardly having any practice.

The characteristic parts of the initial configuration were: 1 M byte central storage (ES 1055); two card readers (ES 6012, ES 6019); two line printers (ES 7033M); five 29 M byte magnetic disks (ES 5061); and five magnetic tapes (ES 5017).

The operating system used was OS/ES 6.1 M 4 in the SVS mode. The hardware configuration hardly made use of the advantages of the ESZR [Uniform Computer Technology System] series 2, but it was suitable for the discovery and solution of many problems and for preparing to start "live" operation.

Since 1 April 1981 the services of the computer center have been available in an operational way for external and internal users. Within a short time the initial hardware configuration was expanded with a six unit 100 M byte capacity magnetic disk system and a TELE JS remote processing system (ES 8371.01 processor, two remote group control 4-4 terminals and four independent remote terminals). We used an OS/ES 6.1 M 4 operating system in the SVS mode, which was delivered by Robotron with the computer. We successfully fitted into the system an IDMS data base management system.

We also tested Shadow and Task Master remote data processing monitors under the control of the OS/ES 6.1. In the interest of more efficient operation we experimented with building in HASP II, but this did not give the desired results due to deviations appearing in the supervisor.

The 6.1 M 4 version did not ensure adequate servicing of the TELE JS remote processing system because it contains neither the CRJE or the TSO possibilities. (According to information received from Robotron an M 8 version will be ready by the end of 1982; it will include a time sharing system also.)

We would have liked to realize conversational mode machine use with developed remote data processing devices but this can be achieved--for the above reasons--only by changing the operating system. At the end of October, after a brief preparation, we switched to an operating system corresponding to the SVS version of the IBM OS/VS2 1.7 J. The spooling technique used in the system is the HASP II and time sharing operation makes possible programming in the conversational mode. Use of TSO in the ES 8371.01 programmable multiplexor emulator mode now serves eight lines, physically constructed. In a brief time the favorable services of the time sharing system came into the center of user interest. The number of terminals today is still small so we have planned acquisition of new terminals and will ensure the possibility that our customers can connect their own terminals to our computer system.

One of the services of the computer center is to provide tools for system compatilibity tests so that a number of users have experimented successfully with generation of various operating systems for developmental and research purposes.

In figure one we see a graph of technical utilizability. The values depicted represent system downtime in percent of all connected time without maintenance. The average technical utilizability for the year of 96.58 percent is outstandingly good, compared to the same index for similar systems. The good training of the technical operating personnel and the quick customer service assistance offered on occasion by Robotron contribute to achieving such a high value.

[Figure 1, 2 inches, has a vertical scale in percent and a horizontal scale in months]

Figure two shows the average mean time between failures pertaining to the breakdown of the system. It is worthy of note that the figure for the system is 57.6 hours but that for the central unit is 135.8 hours.

[Figure 2, 2 inches, has a vertical scale in hours and a horizontal scale in months]

In figure three we can see the average time needed for restoration after the breakdown of the system (MTTR).

[Figure 3, 2 inches, has a vertical scale in hours and a horizontal scale in months]

The more frequent failures worthy of note on the basis of the past year's experiences are:

--a one bit store error in operational storage. (The hardware can correct a one bit error, but this is accompanied by a substantial reduction in operating speed, so it is useful to eliminate the error quickly.)

--a grounding fault in the power unit of the integrated operator's console. (It took a long time to find the cause.)

--contact faults in the printer belonging to the integrated console. (Because of the many faults, difficult to repair, it is useful to disconnect use of the line printer from the system, which does not cause a problem with the OS system.)

--among the peripherals, the photo diode signal generators and the photo diodes of the reading head frequently failed in the ES 6019 card reader.

Naturally, we informed the manufacturing firm about the frequent failures and we received a promise that these would be eliminated in later equipment.

It is worthy of note that the manufacturer still does not always follow up the hardware precisely. This meant modifying certain circuits of the central unit, which is necessary on the one hand to connect additional peripherals and also, on the other hand, to ensure that the hardware always works in harmony with the software.

In general the hardware and software design of the computer system is good. The technical indexes are above the average. The software system needs to be supplemented, but Robotron recognizes this fact and is constantly making up the deficiencies.

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CEMA COOPERATION IN DEVELOPMENT, USE OF MICROCOMPUTERS

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 82 p 12

[Article by Dr Tamas Boromisza and Karoly Stuka: "Microcomputer Development and Applications Cooperation in CEMA"]

[Text] The 36th session of CEMA was held in our homeland. In addition to a discussion of many important questions there was the signing, at the head of government level, of three agreements which have a connection to our special area.

The joint development of robots also requires the use of computer technology methods and tools while the cooperation agreement signed in the area of the microelectronics element base is called upon to ensure a better supply of parts for the computer technology industries of the socialist countries. But computer technology is most affected by the agreement which prescribes multilateral cooperation of the CEMA member countries in the area of the use of microcomputers.

Just one year ago the preceding session of CEMA decided on the preparation of such an agreement. Preparation was entrusted to the Inter-Government Computer Technology Committee, the Radio-Electronics Permanent Committee and a number of other CEMA and international economic organizations, with the coordination of the CEMA Scientific and Technical Cooperation Committees. Solution of this task in not quite one year, a task mobilizing so many high level organizations, can be called a significant accomplishment.

The work is now being transferred from the consulting delegations to applications experts working in the most varied areas.

Attached to the agreement is a work program which contains the task to be realized in the course of the cooperation. The most important part of the program prescribes those tasks of extraordinary importance if we are to be able to follow the explosive spread of microprocessor devices in the past 2-3 years in the developed capitalist countries. We must jointly review the status of the use of microprocessor devices in our member countries and determine the short and long term phases of development.

Of extraordinary importance are those tasks which prescribe an analysis and forecasting of the social and economic consequences to follow as a result of the mass use of microprocessor devices. While the social consequences of the application of computer technology thus far could be handled relatively simply, in the more or less closed circle of experts, the appearance of microcomputers in tens of thousands, and building microcomputer controls into virtually every technical device represent processes of truly social scale. A suitable forecasting of these processes is absolutely necessary and it is of political significance that every affected area of society be prepared in time for the changes. We must organize the training and guidance of masses of users. The program prescribes mutual tasks and exchange of experiences in this area also.

Although all the things listed are important, we consider most important the formulation of the general technical requirements to be made of the basic tools of microprocessor technology, which leads us to the next part of the program. Any sort of cooperation would become impossible in an area as various as the use of microprocessors if we were not able to apply uniform technical requirements and to standardize the solutions.

The most extensive part of the cooperation program deals with the most varied economic applications of systems containing microprocessor devices.

Let us mention only briefly a few product groups to give a feeling for the broad area embraced by the program. The number of various systems exceeds 100, and it is probable that with the spread of the use of microprocessors this number will increase further.

Microprocessor control of technological systems extends to control of gas supply, the cement industry, manufacture of chemical industry machines and control of thermal power plants. This includes control systems which may be used in electric power networks, nuclear reactors, purification and enrichment of metal ores and general purpose control systems which may be used in a broad sphere.

The most varied areas of economic life also use organizational, operational planning and dispatcher systems, beginning with microprocessor optimalization of technological services to surface mining through savings banks, commercial and telecommunications registering and auditing equipment and cash registers all the way to text editing equipment.

The development of modern controls containing microprocessors for the control of machines, mechanisms and machine tools constitutes a large group, in which our homeland also has undertaken a significant part. In addition to customary and well known NC, CNC, and group controls there are many others here also: weaving machine controls, industrial sewing machines, systems to control manufacture of turbine blades and automatic testing and diagnostic equipment.

The part dealing with automatic industrial, scientific and medical instruments can also count on serious interest in our country. In addition to medical instruments the microprocessor increase of the intelligence of various weighing equipment is an interesting theme.

In the area of microprocessor applications for transportation equipment we find ignition and motor controls and instrument panels for passenger cars and trucks, special autobus controls, microcomputer guidance systems for urban, highway, rail, water and air transportation and various reservation systems. A kindred area is the use of microprocessors in various telecommunications systems.

Agriculture is of increasing significance for microprocessor applications--guidance systems for small agricultural enterprises, control of various technological processes in industrial scale animal husbandry, sorting agricultural products according to quality, hot houses, agrometeorological equipment, irrigation systems and the packaging of products.

Of special importance in the present situation are microprocessor applications systems for fuel and energy systems, where any saving we can achieve with these systems is of economic interest.

The same thing applies to various metallurgical applications. Mass use of educational and personal entertainment microcomputers also figures in the program.

One can see even from this sketchy listing what a ramified area the use of microprocessors is even today. So the program does not propose that a single international organization should deal with all these questions. Use of microprocessors in every single area already means the same thing as general technical progress; the representatives of not one single area can refrain from active participation in this process, cannot say that this is a matter for computer technology and microelectronic experts. The program makes the organization of cooperation in developing individual applications systems the task of the individual branch permanent committees and international management organizations. The program or rather a temporary work group entrusted with guidance of execution will do the work.

Hereafter also, ensuring the device base needed for the realization of microprocessor applications systems will be the task of the two main Design Councils (hardware and software) of the Inter-Government Computer Technology Committee. The Applications Council for Computer Technology Devices working within the framework of the Inter-Government Computer Technology Committee is undertaking to discover effective applications areas on the basis of a summing up of experiences in the application of microprocessor technology, defining the basic requirements to be made of devices and working out the technical, manufacturing, legal and commercial conditions for software development and supply.

The program also formulates a few requirements where it will be necessary to set forward the originally given time limits or to expand the previous catalog (for example, in the area of micro-peripherals). We must substantially improve information for the large number of experts working on the creation of microprocessor systems, concerning circuit elements, peripherals and other devices which can be obtained from the socialist relationship.

Another essential part of the program is the chapter which deals with questions of education. This part applies to higher and middle level education and to institutional and study course instruction alike. It extends to developers and users of applications systems; the latter represent very much great masses of people. In addition to a joint development of and exchange of experiences concerning study plans and methodological materials, the program prescribes the use of microprocessor technology in general school instruction and designates the chief directions of cooperation in the area of further training for leading cadres.

The microcomputer applications agreement and the work program for cooperation are aimed at an area which is not only very ramified but which is also developing very quickly. Thus it is of priority importance that the program be open and that it be the obligation of every participating international organization to see to constant actualization and further development in its own area.

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COMPUTERS IN DECISION MAKING

Budapest SZAMITASTECHNIKA in Hungarian No 7-8, Jul-Aug 82 p 14

[Article by Agnes Jakab: "The Mission of Informatics Experts Is Disciplined Service To Laying the Foundations for Decision Making"]

[Excerpt] The fifth meeting of informatics experts was held 10-11 June this year in Esztergom. In his talk titled "The Role of the State Administration Informatics Development Society (AIFT) in Developing and Coordinating Economic Information Systems" Laszlo Haklar called the attention of the audience to why, how and within what frameworks this relatively new association was working. The AIFT was formed in May 1981 at the initiative of the president of the KSH [Central Statistics Office], an initiative begun in the first quarter of 1980 in the wake of the 29 November 1979 Council of Ministers resolution calling for the modernization of state administration. It was created not as an interest protection or advisory organ and not from prestige or state administrative (executive) considerations, but rather to aid the practical solution of concrete informatics tasks. So, "Let us not merely propound systems theory, but rather let us see that we are all parts of a larger system. We must do precisely as much as we must do from the viewpoint of the system as a whole." Let us not argue further and let us not frustrate each other's actions when, for example, deciding who will collect the data. It is obvious that each area is capable of controlling its input so others are not needed (and should not be forced) to do it in their stead. Consistent data files should be stored only by the various data owners. Data bases and processing (information) systems must be built up to supplement one another; system developers must work in harmony with one another. Thus, the goal was to liquidate the greatest deficiency. This is what the members of this association undertook also and already they have some nice achievements behind them on the basis of a 3-year and operational work plan; they are spreading these and they invite everyone into the common shop who might be interested in the creation of "optimalized" economic information systems. It is already a great accomplishment if these specialized informatics institutions get to know one another, their professional traditions and ideas. Since the content and concepts of economic information are not yet fully developed, one should first record the data, then order the conceptual base and finally adjust them to changes taking various parameters into consideration.

The task is of great significance. The transmitter of the economic policy goals of the state is the economic mechanism which also, ultimately, is a manifestational form of economic relationships. The information system must always provide the mechanism with the necessary input, and this is now more difficult with the value orientation which goes beyond the quantitative view. The most important areas in which providing information is indispensable for the preparation of decisions are: watching and supporting the price mechanism; laying the foundations for the credibility of the most varied international comparisons, making the producing sectors sensitive to changes in terms of trade, etc.

Information, the "most perishable commodity," must be in spatial, temporal and substantive synchrony with the decision levels. For the users it must be used as a "finished product." It is insupportable for an organ making a decision to believe itself informed although its information is extraordinarily deficient (through no fault of its own). And since economic and state administrative functions are, by their nature, divided, the information system must develop functional, branch and regional part-systems. It cannot do this without a system of identification, grouping and documentation. Computerized data management itself, as a technique, also demands a mutually unambiguous formulation of all elements which are components of a computerized information system (in other words, a data base system).

What does the AIFT want to do for all this?

Only sketchily, to coordinate the part-systems substantively and logically within 2 years. Within 4-5 years the part data bases will be mutually accessible.

In detail:

--to prepare a uniform data catalog, to describe the primary data files in a way which can be used by everyone involved. This is planned as a publication and in a machine (on-line) version.

--to standardize magnetic tape data flow. To give an answer to every concrete question which asks: How can certain information be accessed? (Who has it?)

--and to harmonize the record keeping of managing organizations, which now can be found in three places--but which were never compatible with one another. This step, which is called upon to put an end to "one of the disgraces of the informatics society," leads also to the question of data security, which in itself is an exciting problem, but especially in connection with preparation for the integration of the entire system. (Let us just think what would happen in this connection if we could "borrow" from our partners not only data but procedures also, and all this will become an everyday practice in a remote data processing network.... And the job before us seems especially great if we cannot postpone a solution at the level of procedures beyond the decade!)

In concluding his horizon broadening list of task specifications Laszlo Haklar also mentioned the tasks of the association coming from outside. These expectations reflect the support of governmental and authoritative organs--we might even say a prior positive evaluation of and trust in the work. The State Plan Committee

hopes that through the AIFT the finalization and delimitation of the data content of the part-systems will be more diligently done. The authorities also expect the association to encourage execution of the 1981-1985 target program of the SZKFP [Computer Technology Central Development Program]. The coordination of computerized activities could improve their influence on the members, primarily in the sense of winning a considerable number of colleagues to the common cause, to successfully bridge the gap between theory and practice.

Realizing the goals and plans outlined projects a very beautiful picture of the future for all of us. But let us look at those flagstones which we are now laying on the road before us. (A volume containing the material of the conference will soon appear, making a detailed review possible. Here and now we can create only the illusion of a lightning survey.)

According to the evaluation of Imre Toth, director of the Computer Technology Center of the OT [National Plan Office], there is a bottleneck from the viewpoint of factual data (the initial information for planning), there is a shortage of branch analyzed data. What there is has a long through-put time, and so is suitable only for long-range planning. For annual and medium-range planning one would need to have information appearing directly, in a visual form; this was formulated as a computer technology requirement. He is encouraging his own development--primarily of software--in the direction of permitting planners to use a computer as a natural tool, having to master a minimum of computer technology information. (Among other things, they have developed a planning language.)

The report by Dr Laszlo Ormai ended with a reassuring announcement. He informed everyone that the two decades long feud of statisticians and computer technologists had calmed down, and this was thanks primarily to developed data management techniques. Thus it is now a realistic requirement that even statistical activity should be economical. In the course of developing data bases problems came to the surface which held back further progress, and all this can be traced back to the lack of integration. For years the internal lack of proportion of the data collection system also held back development. It is an unfavorable fact that the (traditional) observations according to organization are still not always supplemented by observations according to activity or even region. We cannot expect the commencement of the age of interlinked, common use economic and statistical data bases within 5 years, but its realization as soon as possible is hastened with every developmental step. Until then, however, we have enough to think about. What is the optimal size of a data collection system? What sort of realities (data service load-bearing capacity) determine the possibilities and expectations of the statistical organization? What should be the organizational structure, compatible with modern methods, taking the place of the statistical apparatus adjusted to traditional tasks?

The answer to the last question is evident to the extent that the ratios in the division of labor will shift toward functionality. It is also clear that the development of regional systems will bring with it local solution of data control. The rest (to use the words of the speaker) will depend on when the statisticians establish with computer technology tools the sort of relationship they have with their cars or telephones--but with much less irritation. (This is a good lesson, I think, for both sides....)

In what follows I will recommend for perusal a few of the many interesting themes, when you get the promised SKV publication. (I am encouraged to this subjectivism on the basis of the debates and the--perhaps not misunderstood--statements of the section leaders.)

Mrs Lajos Apatfalvi, "Record Keeping Systems of Managing Organizations and Their Links With the Financial Information System." Domonkos Asztalos, Jr and Bela Kreko, "AMETIST, A Conception for a Meta-Information System." Mrs Lajos Baracza and Peter Kulcsar, "Experiences in Realizing a Statistical Data Documentation System." Raimund Blazsik, "Problems in Developing and Operating State Administrative Data Processing Systems for the Councils." Ervin Gombos and Dr Mrs Istvan Weisz, "Administrative Aspects of a Contemporary Data Protection System." Imre Hajdu, "Developmental Possibilities and Constraints of an Identification System for Economic Organizations." Gabriella Koncz and Mrs Imre Pal, "Problems of Building a Link Between the Financial Information System and the State Administrative Information System." Imre Pap, "Experiences in Census Data Processing and a Conception for a Census Data Base." Mrs Karoly Patyi and Lorant Santa, "A Geodetic and Cartographic Data Base; A Uniform National Identification System Based on Geodetic Coordinates." Dr Jozsef Stauber, "Further Development of a Legal Information System Based on a Computer." And Robert Villanyi, "The Role of the PSZTI [expansion unknown, possibly "Postal Computer Technology Institute"] in Data Exchange."

Finally, let me summarize a few ideas and proposals from the second plenary session.

Attila Aranyi, chairman of the section on record keeping by managing organizations: Increased attention must be given to the record keeping problems of the multiplying organizations (including social ones) and the new types of undertakings among them including joint undertakings by cooperatives and the state. We must avoid the danger of biased judgment.

Dro Gabor Parniczky, chairman of the section on statistical meta-information systems: Metasystems have a powerful regulating power. For this reason it is very important, although difficult, to solve the problem pragmatically. There should not be incompatible classification systems and we must eliminate redundancy (at the element, procedural and subsystem levels).

Dr Istvan Vavro, chairman of the section on regional and local information systems: Since council work is a carrier of administrative conservatism the reception of new tools is clumsy. For this reason it is especially important to prepare in time so that changes in regulations affecting this sort of activity should have a significant influence on the efficiency of storage and access structures in the information system.

Dr Jozsef Kovacsics, chairman of the section on state administrative base records: Principles, methods and regulations still lag behind the real needs in the question of data protection and data security. This theme is extraordinarily important for every informatics-computer technology area. Development can only lead through settlement of these questions.

Dr Jonas Szelezsan, chairman of the section on branch information systems: The fact that a common conclusion cannot be given on the basis of the reports concerning branch information systems confirms that the mammoth systems being prepared separately thus far must be developed as subsystems.

Elek Straub, chairman of the section on the planning and financial information system, emphasized, in harmony with the other chairmen, that: The indisputable usefulness of the conference for a mutual exchange of information will be fuller if the debates could "run their course." Unfortunately there was not enough time for this in any of the sections. (This would be absolutely necessary for the proper storage of the ideas expressed.)

It is probable that Lajos Pesti intended it as an orientation so let me give his closing words a bit more extensively. Their content is noteworthy as a sort of "collective self-criticism." He said: "We have committed two errors. First, 20 years ago, we did not begin teaching computer technology and informatics. And, 10 years ago, we did not put forward an information system development program in the pace of the SZKFP [Computer Technology Central Development Program]. It is reassuring that for a few years the emphasis has been shifting toward the organization of systems or toward the methods for this."

8984
CSO: 2502/2

REPORT ON SCIENCE SITUATION ASSESSED

Warsaw TRYBUNA LUDU in Polish 20 Sep 82 p 3

[Interview with Professor Ignacy Malecki of the Polish Academy of Sciences by Adam Hollanek]

> [Text] The Polish Academy of Sciences has prepared a new professional report--as though in response to the hopes which our society attaches now, during the crisis, to the development of scientific research and also to the introduction of new methods and technologies into the national economy. "Report on the Polish Science Situation" was prepared under the direction of Prof Dr Ignacy Malecki.

[Question] Comrade Professor, what do you consider as the most essential in this analysis of the actual state of our science? Is this only an assessment of the present situation?

[Answer] I think that, during the work of the team which was preparing this report, the matter of presenting and submitting to the scientific community for discussion both the analysis of the present state of science as well as programmatic suggestions for the future came to a head. It would have been difficult not to draw conclusions from what we have studied and what we are trying to assess honestly and critically. Initial discussion will begin shortly in the Science Study Committee of the Polish Academy of Sciences. In the report we have attempted, probably for the first time in such a comprehensive way, to present the capabilities and needs of science in relation to its available means. And all this against the background of import and ambitious research programs.

A second, very essential field, which we have delved into, is the presentation of the mechanisms of putting of scientific research into practical application and the difficulties in accomplishing such tasks. Major errors of scientific policies in many recent years still linger on. For example, the insufficient participation of the considerable, after all, research and developmental potential of our country in the innovative processes was not justified by the state of Polish research. The orders-distribution system has led to a decline in the autonomy of units in the national economy that was, of course, obscuring the picture of the actual needs of those units as far as the flow of

scientific innovations was concerned and was complicating the cooperation of scientists with industry. In the report we have also enumerated various other aspects of this problem. It presents a very differentiated picture of our science which has to its credit many accomplishments acknowledged in the world but which, at the same time, often cannot fulfill the expectations of the economy and of society. Of course, it must be stressed at the same time that science of a medium-size country cannot possess a panaceum for all the ills which plague us. Science, after all, should be viewed as an integral part of the life of the whole country. This is indispensable.

[Question] Is it true that there is a very large disproportion between the level and the capabilities of our scientific cadre and the material base available to it?

[Answer] I consider, and our report stresses this also that the development of a cadre of scientists of a really high caliber is to be one of the greater accomplishments of our country. This is a great trump card. It is true that the material base of our science is very, very weak. The result is that experimental research (important, after all, both indirectly and directly for practical application) is of an extensive nature and is dispersed. Hence, it is not very effective. In my opinion, however, the weak material base is a lesser evil than a weak education would be of some small cadre of scientists. Searching for persons suitable for science and educating them involves many decades. Nonetheless, the material base can and should be, of course, improved quickly. In 1980 more than 70 thousand personnel having the highest scientific qualifications was listed. Unfortunately, educating of the cadre has slowed down. It is caused by the continuing limitations in employment. Because of it fewer young people manage to reach the centers of scientific research. The fault, of course, is primarily the lack of experimental workshops. Thus a vicious circle is formed. And here one should expect significant help from autonomous economic units. After all, developing of contacts with science is in their own interest, i.e., the outfitting of new laboratories by using at least a small portion of foreign exchange which they have earned. In other words, we are counting on large enterprises!

[Question] Among the many issues, which required a thorough study and a change of strategy is, no doubt, the question of appreciating and supporting basic research without which any development of science is simply impossible. How does the report treat this problem and what formulas does it propose?

[Answer] In all fields of science the report attempts to propose actions which would at least alleviate our difficulties. Those actions are to be based on an appropriate strategy of scientific research--that means in this instance--on a careful choice of direction of scientific research and of the degree of concentration of forces and means for chosen problems. In the report we write that "coverage of the entire field of science with only a thin layer of resources in such a way as to assure at least a minimum degree of conducting scientific research is proposed." As one can see, action on a wide front is assumed so that each one of our scientists could have his "place in the sun." This obviously pertains also to basic research. At the same time we postulate in the report the selection of a few of the most important problems of a wide, comprehensive scope that allows for maximum utilization of the potential of both the basic and technical disciplines. This is not supposed to be some rigid

structure, a bureaucratic or overly technical structure (as it happens frequently, for example, with governmental problems). It is to be a broadly conceived concentration of scientific activity on the problems most essential for our society. Here are some examples. It appears to us that the most important matters include the modernization and reconstruction of the labor system: wage systems; labor incentive; land labor law; and employment policy. In this field there is a need for a particularly great effort by science and also for frequently conducting really pioneer-type--in our country--research.

Another great problem is, "the organization of management of the state." "Only on the basis of solid scientific research there is the guarantee of avoiding glaring errors committed in the past in constructing and operating management systems"--as we state in the report. The third important sector is based on "the maintenance and rational utilization of national wealth." Of course, there is an enormous role to be played and an enormous field for action for many scientific disciplines, including particularly the heretofore neglected social sciences.

Among the basic problems one should also consider "improvement in the production and processing of agricultural products." This is a classical example of versatility of scientific activities.

Here one assume that its role is not only to solve the problems of agricultural products--just the agricultural sciences--but also the social, biological, technical problems. Here the concern is for the best cadre of those who are to work in agriculture, as well as for the production of improved fertilizers, insecticides and implements, for food processing, and for waste utilization. One also should not forget about basic research in photosynthesis, in biological assimilation of nitrogen from the air and in genetic engineering which opens new perspectives for agriculture.

Problems of similar degree of complexity that require the cooperation of many innovators of science include: "rationalization of the management of raw materials"; "territorial development of the country"; "environmental protection"; "protection of the nation's health"; and "rationalization of exports and imports." One cannot list here everything.

There is no doubt, however, that such comprehensive solutions of this science strategy must be accompanied by a very carefully considered financial policy. Organizational-unit [plant and equipment] financing, that is, financing of selected research units, will probably be even more concentrated than that up to this time. The source for it is to be a state fund and a fund centrally managed and originating from taxes and from other forms of charges from enterprises. This type of financing should include all three branches of science. Organizational-unit financing consists of appropriating of monies to specific centers or teams which show promise for positive results in research. We are proposing that it should have its source in that part which is managed primarily by the Polish Academy of Sciences and the Ministry of Science. The third form of financing research would be the contracts concluded by individual enterprises and scientific centers.

Centers which carry out research for the enterpirses should become financially fully independent or should even become permanently connected with the enterprises of the national economy. We envisage the participation of special scientific entities, such as the Council of the Fund for Basic Research or the Council of the Fund for Technical Progress, in the equitable appropriation of funding for science. They would be a factor which would democratize financial decisions and would facilitate identification of actual needs of individual scientific disciplines or individual centers of scientific research.

Discussion of these matters is just beginning in the scientific community.

Interviewer: Adam Hollanek

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END

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17 December 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 762

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17 December 1982

EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

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CONDITIONS FOR FASTER MAIL DELIVERY EXAMINED

Prague PTT REVUE in Czech No 4, 1982 pp 104-106

[Article by Eng Miroslav Spacek, Federal Ministry of Communications: "Mail Delivery Time"]

[Text] The speed with which mail is transported and the timeliness of its delivery are unquestionably among the most important criteria by which the public in any country judges the quality of postal services. It is not easy to meet these requirements consistently; they depend on many factors, some of which are difficult to influence. A legally constituted plan for postal transport alone is decidedly not enough: also necessary is precise adherence to procedures and directives by all workers involved in the mail-carrying process. Failure of one link generally hinders the performance of all the others. But in addition to the human factor, the reliability of the transport and delivery service is also affected by physical facilities, particularly mail transport centers, and the reliability of the carriers and transport facilities. The ultimate quality of performance is equally dependent on good cooperation by the public, particularly as regards adherence to mailing requirements.

The fact that all of the above-mentioned requirements must be met simultaneously is certainly one of the most important reasons why time limits for delivery have never been part of the universal legal specifications for the Czechoslovak mail service. Time limits for delivery of various types of mail have been defined only in the operating instructions contained in Postal Regulations II, where they are meant to be used in development of the postal transport plan.

In an attempt to solve this problem, the Federal Ministry of Communications asked certain European postal services how they established transport time limits for the public and what the responsibilities of the postal service are in regard to them. The responses confirmed that precise specification of delivery times and associated specification of the postal service's liability for compensation is an extremely complex task which the postal services usually do not address unambiguously in their compulsory general regulations.

East Germany

In the GDR, delivery times are specified by an internal instruction with which the public is not acquainted. They are based on requirements for rapid transport of information and the economically substantiated capabilities of the

postal transport network. The delivery time specifications differ for the individual types of mail and for the various levels of the transport network. Letters are to be delivered within the same bezirk on the next day and within 2 days in other bezirks, while international mail is to leave the country within 2 days of mailing. Parcels to be delivered within the same bezirk and rush parcels to be delivered anywhere in the country must be delivered within 2 days and those to other bezirks within 3 days, while international parcels must leave the country within 4 days.

The GDR postal service guarantees the contents of the mail if delivery takes unusually long and the contents are spoiled for this reason; express surcharges are the only fees returned. The management of the postal service decides on compensation with reference to the internal time limits mentioned above. In the case of letters, delivery times are monitored by means of control mailings, while package mailings are monitored through postal service documents. This monitoring is performed by selected postal employees in all bezirks, kreis and other large cities (selection for this work is considered an honor). They are employees involved with mail classification, with the exception of those at the transport centers.

Bulgaria

The compulsory general instructions in Bulgaria do not establish delivery times, but care is taken when developing the postal delivery plan to assure that these times are as short as possible. The post offices' connections to the transport network are precisely specified, and they must subordinate their own operations, particularly handling and dispatching, to this network. Postmasters and responsible employees are called to account for failures to adhere to the postal transport plan when they affect delivery times. Breaches of transport procedure are dealt with via poor-performance reports, which are sent not only to the post office from which the mail in question was sent, but also to its superior management.

Austria

Compulsory delivery times in Austria are defined in the postal law, which specifies a limit of 3 days for registered letters and 4 days for other registered mail. Postal responsibility of this sort does not apply to ordinary letters. At a time when the volume of postal operations is constantly increasing, delivery times are doubling. Since the work week was decreased to 5 days, no deliveries have been made on Saturdays, with the exception of daily papers, express letters and telegrams. The post regulations authorize postponement of the delivery of mail sent in such large quantities that it would create difficulty in delivering the rest of the mail. Under the same conditions, delivery of printed matter may be delayed to the next postal rounds. This makes it possible to prolong the total delivery time for these types of mail. The internal objective of delivering letters the day after mailing is met in about 90 percent of all cases. This result, which is considered excellent, was achieved by means of recent investment in modernization of postal transport (establishing postal express trains, mechanization of mail transport centers, introduction of containerization). In practice, delivery times are

checked with both "live mail" and control mailings. Devices for recording delivery times have not as yet given satisfactory results.

Switzerland

In Switzerland, delivery times are not specified in the compulsory general instructions. However, an internal directive requires that letters, manuscripts, daily newspapers, express periodicals and express printed matter be processed and dispatched without delay. The small size of the country and the numerous connections make a more strict specification unnecessary. In the case of parcels, the principle is that a package mailed in the morning should be delivered (insofar as postal connections allow) on the next working day, and in other cases on the second working day after the day of mailing. The postal law specifies that in case of a delay of more than 24 hours beyond the normal delivery time for registered mail, packages and mail of declared value, the postal service will compensate actual loss, not to exceed 150 Swiss francs. The normal delivery time is determined from case to case in terms of the connections available. The postal service is not responsible for unregistered mail, but claims are checked in order to discover organizational errors and fault by postal workers. Delivery times are checked every few months at three post offices designated by the general management; three new offices are designated every year. The canton management organizes its own more detailed checking for the individual stages of transport. Operating inspections play an important role; every year the transport activity of 200 post offices is monitored.

* * *

Supplement 10 of the Postal Regulations, developed on the basis of an evaluation of foreign experience, but particularly with reference to the actual capabilities of the postal transport and delivery services, specifies compulsory delivery time limits and the associated responsibility of post offices. Mail-carrying time refers to the collection, transport and delivery. Carrying begins on the day the mail is received by the post office and ends on the day of its delivery (or when notice is given or arrangements are made for it to be called for). Timely delivery of domestic mail entails delivery of letters, postal money orders, manuscripts of value and rush parcels no later than the second day after mailing, and parcels no later than the fourth day after mailing.

Saturdays, Sundays and other nonworking days are included in the time limit only if the mail in question was required to be delivered on these days by the relevant provisions of the Postal Regulations and the established delivery responsibilities of the cognizant post office. Adherence to these limits is always contingent on the meeting of mailing requirements by the customer. If a piece of registered mail is delivered later than the time limits noted, the post office makes restitution, on the basis of the claim procedure or authorized payment claim as per Para 55 of the Postal Regulations, and the standard surcharge for rush delivery of parcels.

While designating delivery times and the extent of post office responsibility, it was also necessary to devise more objective methods of checking mail delivery times. The solution of this problem is most difficult in the case of

ordinary letters, for when these are delivered the post office has no records from which the quality of service can be evaluated. Previous monitoring on the basis of "live mail" was limited to determining transport times, and accordingly took no account of the final phase, namely delivery. In addition, the monitoring was mostly conducted at mail transport centers, by personnel who had a certain stake in the results achieved. On the other hand, this method was used to check a large number of items (for example, a one-time nationwide check in 1978 dealt with 522,000 ordinary letters).

The new method of monitoring delivery times for letters, including mailing, transport and delivery, is that of control mailings, which selected ministry employees will send between all districts in Czechoslovakia. Each piece of control mail will contain a control card suitable for machine processing. package delivery times will be monitored by the same group of reliable employees for the largest post office in each district. The control sample will include at least 100 packages mailed separately on a single day.

The data from this mailing will also be machine-processed.

A computer output will make it possible to determine the total number of items mailed, the total number of items delivered within the specified limit (taking account of the provisions of Para 1024 of the Postal Regulations II), a survey of items delivered after the established time limit, broken down by point of mailing and point of delivery, and a survey of points from which control mailings were not dispatched.

The size of the test sample which would characterize the situation in the transport network with sufficient accuracy was determined using the methods of mathematical statistics. The quality level will be checked by control mailings sent from n mailing points to n-1 destinations. A total of $N = n(n-1)$ test items will be mailed. If we estimate the percentage of delayed items as $P = 10p$ (percent), and if we wish for the result to have a relative accuracy

$$\delta = \frac{r/N-p}{p} \tag{1}$$

where r is the number of delayed items out of the total number N, then the required number of pieces of test mail is given by the equation

$$N = \frac{\mu^2 \frac{a}{2} (1-p)}{\delta^p \cdot p} \tag{2}$$

Here $\mu \frac{\alpha}{2}$ represents the cutoff quantile for a confidence coefficient value of $1 - \alpha$. It follows from equation 2 that with the given value of p and of the confidence coefficient $1 - \alpha$, the sample size increases as the demands for relative accuracy of the estimate are intensified. If the relative accuracy is constant, the sample size will be greater the smaller the value of p. The sample sizes for the most commonly used confidence coefficients of 0.90 and 0.95 are given in the tables.

$1-\alpha = 0{,}90$

p	0,20	0,10	0,05	0,01
0,20	271	809	1 286	6 698
0,10	1083	2436	5 142	26 790
0,05	4330	9742	20 566	107 159

$1-\alpha = 0{,}95$

p	0,20	0,10	0,05	0,01
0,20	385	865	1 828	9 511
0,10	1538	3 459	7 302	38 042
0,05	6149	14 834	29 204	152 166

The fully satisfactory values are given for $1 - \alpha = 0.95$ in the enclosed sections of the table; for example, to test the hypothesis that 95 percent of the items mailed are delivered within the specified time, with a confidence coefficient of 0.95 and a relative accuracy of 10 percent, it is necessary to use a test set of 7,302 items. Thus we can close this discussion by stating that N = 1,000 test-mailed items gives sufficient reliability and relative accuracy; but in reality the test mailing will be still larger, since n = 122, i.e., N = 14,762 items.

The new checking method, which will go into operation this year, will make it possible not only to check the overall quality of all stages of the mail-handling process, but also to track the specific links in which the delivery time does not meet the specified limits. The final data will be available to the Federal Ministry of Communications, the two central communications directorates and the local communications directorates (or postal directorates). The findings will be thoroughly analyzed or checked in more detail by means of additional investigations so that measures can be taken to eliminate the causes of delays in the mails.

8480
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DATA ON SPACE EQUIPMENT PRODUCTION RELEASED

AU070936 Sofia BTA in English 0810 GMT 7 Dec 82

[Text] Sofia, Dec 7 (BTA)--Ten years ago the first Bulgarian space appliance--one for measuring the concentration of the electronics and ions in the ionosphere--was launched in round-the-earth space the "Interkosmos-8" satellite. Since then the Bulgarian space equipment has been flying in space annually--on satellites, meteorological and geophysical rockets, space craft and orbiting stations. Space appliance-building has turned into one of the industrial sub-branches. More than 70 enterprises in this country are engaged in fulfilling the designs of the central laboratory for space researches, the central laboratory for higher geodesy, the geophysical institute and other institutes and laboratories of the Bulgarian Academy of Sciences and departments working on the "Interkosmos" programme. A number of instruments designed for space research, have already been applied on the earth, in various branches of the national economy. This type of space transfer will be considerably extended in future.

Space appliance-building in Bulgaria develops in six main directions: electronic devices and systems for plasm measuring, electrophotometric apparatuses, earth measuring complexes, devices for meteorological rockets, for distant earth probing, for piloted measurements by spacemen.

During the two Bulgaro-Indian space experiments with the "Centaur" rocket, the Bulgarian optical electrophotometer "EMO" was used to obtain valuable data about vague optical radiations on the equatorial region. The "ISOH" series of devices for measuring spectral reflection characteristics of earth objects have been applied in the aero-space researches in the Soviet Union, Czechoslovakia, Poland, Cuba and other countries. In Italy and Yugoslavia there are operates earth stations, [as received] equipped with Bulgarian devices, for measuring the ionispheric absorption, and in Cuba, Vietnam and in India--stations for monitoring the natural optical emissions in the round-the-earth space. Similar stations were used in an expedition variant in Greece and Guinea.

For the flight of the first Bulgarian spaceman in 1979 the Bulgarian designers have developed three unique appliances--a multichannel chamber

"Spektar-15" for measuring and registering the spectral reflection characteristics of earth objects, a photometric system for monitoring shining objects "Duga" and a device for studying the psycho-physiological state of the spaceman, "Sredets." These devices were operated on the "Salyut-6" space station and are now included in a set of the scientific instrumentation of "Salyut-7."

Last year two Bulgaro-Soviet artificial satellites were launched into round-the-earth orbit--"Interkosmos Bulgaria-1300" and "Meteor-Prioroda." On the first of them designed for global study of the high earth atmosphere and in particular for studying the relation between the ionosphere and the magnetosphere, there have been mounted 12 Bulgarian devices and systems. On the second satellite which probes the earth from the space, the Bulgarian appliances are three. On both satellites the instruments continue to operate faultlessly, although the "guarantee period" has expired long ago.

Now the Bulgarian appliance builders are getting ready to participate in new big international space projects. Together with Soviet and French specialists they are designing a probing apparatus to be launched in 1986 for studying the Halley's Comet. Participation is also planned in the intricate complex of devices for direct studying of Mars and its satellites.

CSO: 2020/7

CSAV INTERVIEWS INDICATE FUTURE PROGRESS

Prague SVET PRACE in Czech and Slovak No 21, 1982 pp 3-7

/Interviews with members of CSAV [Czechoslovak Academy of Sciences] and text prepared by M. Dastich, J. Hajkova, J. Honzik, L. Hoschl, J. Kottas, M. Moricova, M. Rubesova/

[Excerpts] Out of the Past into the Future

[Question] The Czechoslovak Academy of Sciences /CSAV/ is "only" 30 years old. We asked its chairman, Academician B. Kvasil, what its future role will be.

[Answer] The year 1982, which marks the 30th anniversary of the CSAV, is very important for its future work. As early as January of this year, we discussed with the CPCZ Central Committee a long-term program which will determine the academy's entire future orientation. The starting point in the elaboration of this program was rooted in the resolutions of the supreme party and government bodies, especially resolutions of the 16th CPCZ Congress and the Central Committee plenum of 1974 which dealt specifically with the questions of scientific progress in this country. The academy bases development in all its disciplines on these resolutions.

[Question] The foundation of your efforts, of course, remains in scientific and research endeavor?

[Answer] The content of the scientific research program in the sphere of basic research was set forth on the basis of two considerations, namely, to contribute as best as we can to the fountain of world science, while not losing sight of research which helps the development of our own national economy.

[Question] There have been calls for some time now for higher effectiveness in scientific research.

[Answer] There are two roads leading toward this goal. The first is the proper selection of subject matter which must reflect the professionalism and capabilities of our research facilities, as well as the needs

of our economy. It is not only in the sphere of natural and technical sciences but in other disciplines as well, that our research institutes must first deal with that which most enhances the effectiveness of production. The second road consists of the shortening of the science - production - utilization cycle. It is absolutely necessary to introduce as quickly as possible all achievements in basic and applied research into practical application, thus transforming them into assets needed for further political, social and economic progress.

[Question] How do you propose to attain these objectives?

[Answer] We have introduced a system of priority tasks. In order to contribute most effectively to the world fund of knowledge, we have joined our efforts within the framework of international cooperation, notably with Soviet organizations. For these are rather ambitious forms of research which we would be unable to handle alone. Therefore, we share with scientists of the other socialist countries in many programs. It is, first of all, the INTERKOSMOS program and joint nuclear research in Dubna; we also participate in the resolution of thermonuclear syntheses, and there is good cooperation in biological sciences, for example, in the sphere of gene engineering, the struggle against epidemic disease, etc. International cooperation in the latter programs is conducted under the INTERMOZG program. All in all, we participate in 16 joint programs.

In order to focus our attention systematically on scientific research which would most rapidly bring economic results, we have concentrated our endeavor on the so-called targeted projects. These derive from the state targeted programs approved last year.

[Question] Which spheres of our economy will most benefit from your targeted projects?

[Answer] Practically all of them, engineering, electrotechnology, agriculture and electronics, including optoelectronics. Of importance are the projects for technological equipment and scientific instruments needed in the production of integrated circuits, e.g., electron, ion and roentgen lithography. Another targeted project deals with the search for raw material deposits at great depths. This will be our contribution to the resolution of problems related to our insufficient raw-material base. The goal is to eliminate the lengthy and costly test probing and surface mapping of our territory at greater depths. Other projects are important for our agriculture. We are dealing with integrated protection of plant and animal life from parasites, gene engineering and manipulation, etc. The utilization of phytomass should produce economic gain, for example, lumber waste and straw can be used for the production of fodder yeast. Cellulose waste can also provide production raw material. This is the aim of the new cellulose plant planned in Paskov.

Altogether, there are 19 targeted projects. Individual research stages are contractually ensured in agreements with our partners. The aim is to achieve concrete results within 10 years at the latest. So much for the content of our future work.

[Question] The program, however, also outlines how these tasks will be implemented.

[Answer] One section of the program sets the task of even closer cooperation between our facilities and the implementation sphere, not only branch ministries but directly with the VHJ [economic production units] and large enterprises as, for example, SKODA, CKD, as well as certain JZDs [unified agricultural cooperatives] (e.g., Prace near Znojmo). I would like to emphasize that we now have very good cooperation with the Ministry of Electrotechnology. All agreements clearly specify that scientific and technological achievements would be implemented by production as rapidly as possible. We believe that it is only in this manner that the Academy's efforts will more closely reflect practical needs and shorten the above-mentioned science - production - utilization cycle.

[Question] Does the adopted program include progress in social sciences?

[Answer] Here too, the aim is to gear research toward practical application. For this reason, we will have to intensify cooperation with party and government organs, trade unions, etc. The academy offers a much more effective utilization of the respective research institutes for concrete tasks in the sphere of planning, sociological problems, social development of society, struggle against hostile ideologies and, last but not least, for education and formation of the profile of socialist man. At the same time, we do not intend to overlook the humanities as, for example, the sciences of art, history, etc. Our long-term goal is also a harmonious profile of the population's cultural level in the period of accelerated technical development of humanization of the technical branches.

Another important area of responsibility for us concerns our prognostication activity. We must provide estimates of the direction in which our individual disciplines will be developing. In other words, we must use the academy's assets more intensively in long-range forecasting of our society's progress. The CSAV is ready to assume responsibility for this important effort on the national level.

[Question] In order for the CSAV to fulfill all these tasks successfully, it will need organizational and cadre backing, capital investment...

[Answer] The program does not overlook the economic and organizational support of our work. We must substantially improve the realization base, i.e., establish additional developmental workshops and prototype laboratories, ensure access to scientific and technological data, equip our facilities with modern instruments... We realize the support the state can provide for science is not unlimited. Consequently, we must apply strict measures of economy and conservation in handling literally every last crown, and make sure that every investment brings the best possible results. It is not always easy to decide where and in what amounts to make allocation of funds.

In closing, I would like to note that we also devoted much attention to management matters, both within the academy and nationwide. Within the academy, we have adapted the structure of the presidium and its auxiliary organs to these new tasks, we are in the process of integrating institutes, establishing regional centers (for example, a biological facility in Ceske Budejovice) and, following thorough analysis, we have pinpointed certain programs which will have to be cut for a number of valid reasons. We aim at a concentration of effort and means to avoid their ineffective splintering.

We have great hopes for cooperation with the Ministry of Education. We want to mutually harmonize our programs, establish joint worksites in order to make the best possible use of the academy's scientific potential and often unique outfitting of certain laboratories and workshops for the education of young specialists.

This then is a highly condensed survey of the academy's future tasks.

What Would Academician Heyrovsky Say to All This?

When I walked around the Lesser Quarter in Prague looking for Vlasska St, I reviewed in my mind, as if a student before a test, what this scientific discipline of which I wanted to learn more had in its magic power. It is currently able to detect not only noxious matter in the air, water and soil and analyze the composition of heavy metals in salt water, but also determine the level of medication in an organism and answer the question of how much lead can penetrate a tin of canned food. In addition, I know that it performs many other miracles.

The CSAV Institute of Physical Chemistry and Electrochemistry of Jaroslav Heyrovsky bears the name of the discoverer of polarography who, as first in this country, was awarded the Nobel Prize for it in 1959. Many years have passed since then, yet the polarographic method is still considered one of the fundamental processes in analytical chemistry. It has not stagnated in its development. The scientists at the institute made sure of that and carry on the work of Academician Heyrovsky with apparently the same dedication and success as the founder.

As stated in the definition, polarography is an electrochemical analytical method the basis of which is in measuring the dependance of the intensity of current flowing through the input voltage (polarographic curve) in electrolysis of the solution by means of a mercury droplet electrode. Naturally, for a layman these words are not easy to understand; therefore, let us hear from an expert, Dr. Robert Kalvoda, deputy director of the institute who, incidentally, studied under Heyrovsky: "It is a relatively simple, yet very sensitive method for determining the presence of many noxious substances, such as pesticides. It alerts us to concentration which could be very dangerous for consumers, thus the method is essential even for the food industry, just as for the pharmaceutical chemistry, which uses it to identify toxic matter."

Progress, however, does not stand still and new, more modern but also more complicated and expensive methods had been discovered, e.g., the chromatographic method or atomic absorption spectroscopy...which provide serious competition for polarography. At first glance, it would appear that polarography had been surpassed, but this did not last long. It all began about 10 years ago when, under the supervision of Lecturer Kalvoda, a complex rationalization brigade was organized where research was represented by scientists from the institute and the production sector by developmental researchers from the Laboratory Instruments enterprise. They provided a definitive answer in the form of a new generation of Czechoslovak pulse polarograph. The problem stemmed from the fact that the original classical method did not allow raising the sensitivity of polarographic instruments.

It was only progress in electronics which made possible the construction of a very sensitive pulse polarograph.

"The bulk of our work consists of development of polarographic instruments. Naturally, there is little sense in conducting any type of research unless it can eventually be applied in production. Consequently, we based our work on collaboration with the specialists from the Laboratory Instruments enterprise. This soon produced good results. Each new idea we came up with was first tested in the enterprise. This was followed by a discussion where the practical merits of the idea were weighed and methods of possible utilization examined. We have gradually developed and built polarographic instruments which are as much as a thousand times more sensitive than the original. Among the latest models now on the market is the PA 3 polarographic analyzer with a static droplet electrode which makes possible automation of the entire polarographic method. As one of the first in the world, it was manufactured by Laboratory Instruments which simultaneously produce the previous PA 2 model. Eighty percent of the production capacity goes for export." Last year the PA 3 was awarded the gold medal at the Brno International Fair. In contrast with the classical method when analysis took about 20 minutes, today the new methods provides the desired results in 100 seconds.

The most timely usefulness of polarography today is in the environmental sphere when pollution causes infestation by the most diverse types of harmful matter. Current development in this field leads to automated analyzers based on polarographic principles, since these provide reliable results rapidly.

Many years ago, Academician Heyrovsky put together the first polarograph. A few decades later, his pupils managed to enrich polarography by new discoveries, especially in the sphere of the natural environment, and bring it so far today that in the near future a UNESCO coordinating center for electrochemistry of the natural environment is to be established within the institute. What would the teacher have to say to this?

How to Mass Produce Intelligent Matter?

Everyone agrees that the scientific and technological revolution began with the invention of the integrated circuit for minicomputers and microprocessors.

The integrated circuit is the basic component of all modern instrument and machine equipment. Its production presupposes the ability to emplace hundreds of transistors on an area of 5 square millimeters. It cannot be assembled by hand alone. The human hand must be equipped with a micromanipulator and the human eye with optical aids. Despite the invention of assembly machinery controlled by man, the outfitting of industrial production branches with microelectronics was a slow process all over the world because production of an integrated circuit took a long time even with the assembly machinery. It was nothing but a piece of manufactured product, albeit of an advanced type.

Then we heard that a machine had been developed in the United States which could mass produce the integrated circuit. Analysts had anticipated the eventual invention of such a machine. The country which owned it could modernize its industry faster than anyone else. In America, this equipment became the most guarded secret, since it in effect made economic blackmail possible.

During about the same period, a few scientists and technicians were working on similar equipment at the CSAV Institute of Instrument Technology [UPT] in Brno under the supervision of Academician Armin Delong. Although they did not enjoy the same conditions and had no knowledge of the American prototype, they succeeded as only second in the world in developing a functional and unique electronic lithograph.

This bit of news acted like a bomb, since it had been anticipated that the United States would maintain a monopoly for several years. The institute staff did not consider this achievement a sensation, but rather a logical culmination of long and dedicated work. Back in the early 1950s, the institute workshops produced, for example, the electronic microscope which went into production in 1955 and has since become, in its eighth incarnation, a popular product of our industry on foreign markets. The Metra Blansko enterprise had received from the institute a prototype of a laser inerferometer. This also was, and perhaps still is, the hit of the season.

The scientific achievements and sensations tend to overshadow the research methodology of the institute. Ever since the early stages, management has always established contact with potential producers. It willingly opened the door to technicians, technological specialists and economists. In most cases, this meant that in the final year of research and development, the future producer was already part of the team, which enabled him to assess objectively and early enough what his enterprise had to do to create conditions for the realization of the new product.

This methodology was the sword which cut the Gordian knot in the sequence of research - production - utilization, nor should one underestimate the moral factor involved. Enthusiasm breeds more enthusiasm, and if the producer personally witnesses the enthusiasm of the researchers, he himself becomes dedicated to the cause and more easily overcomes obstacles which are bound to emerge with any new product. The cycle of transferring research into production thus becomes shorter by at least a year.

Also interesting in the work of the institute is its personnel policy. All told, it employs only 200 people, of whom 100 are scientists and technicians, while another 60 slots are reserved for outstanding workers capable of turning the impossible into the incredible. Only the remaining 40 people take care of transportation, building maintenance, food catering, the reception area, as well as all administration. We must admit that such a composition of a collective is not exactly typical in our conditions. Also unusual is the devotion to work. It seems that this institute simply does not tolerate second-rate performance. In short, one might say that here is a case of the right people in the right place.

Equally interesting would be a glimpse at the capital investment effectiveness of equipment-outfitting in the institute. The conservation trend in this sphere which is just beginning to penetrate our scientific establishment, is already well known here. In other words, it has long become an accepted factor. A scientist possessed of truly innovative vision is also able to apply effective improvisation in the methods of research. Those are the words of Armin Delong, the institute's director.

The UPT was established for the needs of the Academy. The technical disciplines of the CSAV and their institutions had at the time of their establishment often found themselves with empty hands. Scientists the world over were building the needed instruments themselves. Since then, however, many companies have come to the realization that production of scientific equipment can be a very profitable enterprise. Production and mass production followed.

The results of the experienced UTP collective henceforth focused on production and became participants in the profitable exchange and trade in scientific instr ments. Put in lay terms, we can exchange our outstanding industrially produced instruments for other top-quality equipment available in other countries, even if this is done indirectly through the intermediary of our foreign-trade enterprises.

But let us return to the electronic lithograph. One of the first theoreticians of the scientific and technological revolution was a Czech sociologist and philosopher, Radovan Richta. We refer to him here primarily because it was he who had formulated the concept of this revolution as a state where science itself becomes a productive force. Nowhere is this theory more applicable than in microelectronics. In order to realize ideas, it is essential to find the means with which to do so. Integrated circuits represent the materialization of this idea and simultaneously the long-sought means. They add to the conditions of production, namely, energy, material and labor, a new element of information translated into impulses.

In a state which possesses a developed electronics industry, all other spheres of material human endeavor progress faster than ever before.

Return to Nature Its Lost Balance

When at the end of the Sixth 5-Year Plan the CSAV management deliberated on the targeted programs by means of which its institutes were to respond to the most serious problems facing us, it ruled without hesitation in favor of two programs of the Entomological Institute. It is actually one single program, since the implementation of its first part, "Integrated Protection of Plants," simultaneously deals with the second, "Ecological Optimization of Environmental Protection."

We discussed the integrated protection of plants with Dr Karel Novak, Candidate of Sciences and deputy director of the Entomological Institute. Dr Novak explains: "Our aim is to find ways, methods and procedures of plant protection which would reduce the need for the use of chemicals to the lowest possible level, to formulate principles of their least harmful application, and replace them with natural biological protective agents which do not infect the soil or what it produces. With respect to chemical protection, we have formulated ways of reducing its harmful effects via three main principles. First, to use insecticides only when the damage threatens to spread beyond acceptable economic bounds, since treating plants and trees on a calendar plan could cause more damage than the attacker. Second, choose the best possible timing for unavoidable chemical intervention so that most of the effect is absorbed by the attacker and least by the vegetation we are protecting. Third, wherever possible use selectively operating insecticides of which, however, there are not enough."

A substance effective against the leaf-eating caterpillar in vegetable and fruit gardens has already been discovered 20 years ago. It was then patented as a method of using the spore called Bacillus Turengiensis. The producer is JZD Slusovice and the substance will probably keep its original name Baturin.

Another name without a producer as yet is Boverol made from the entomophagous mushroom Beauveria Bassiana, which can be used in a moist environment against caterpillars and larvae.

An entomological hit of the past 10 years throughout the world has been the so-called feromones. These are substances making possible insect communication.

Feromones have been successfully used here in determining the degree of attack, timing of chemical protection, as well as directly against the attacker in orchards and especially forests.

In his book "Remarkable Encounters," Dr Jan Zdarek offers interesting information on the feromones, i.e., insect communication. It is too bad we cannot assist the feromones from time to time through communication

among higher species. Words, evidently, are sometimes not enough as we see in the institute's intense effort to develop usable and effective protective substances in this area.

Development of Society

Our society, which is on the road of building socialism and communism, must develop on the basis of knowledge and application of the scientific legalities of its progress and motion. Consequently, institutes dealing with specific problems of social sciences are an integral part of the CSAV. The basic methodological principles in these institutes are anchored in Marxism-Leninism. This teaching, however, must be constantly and creatively developed, which is one of the basic missions of these institutes. There are many of them, for example, the Institute for Philosophy and Sociology, the Psychological Institute, the Oriental Institute, the Pedagogical Institute, etc. We obviously cannot in this short historical presentation on the academy's 30th anniversary include details on the work of each of its institutes. We encounter the results of their work at every step in our everyday life, not only in the forms of applied science but also in the form of a considerable amount of published material which is reaching the readers and acquainting them with the results of the efforts of our scientific front.

The Czechoslovak Academy of Sciences is a national organization. One of its component parts is the SAV whose many institutes and scientific worksites have achieved world fame through their accomplishments. We have asked Academician and SAV Chairman, Vladimir Hajko, about specific tasks handled by the SAV and the results achieved.

[Question] Can you briefly acquaint our readers with the social mission of the SAV?

[Answer] The establishment 30 years ago of the CSAV and shortly thereafter the SAV, was part of the purposeful policy in science and technology of the CPCZ and our state. Based on the example which had proven its merit in the USSR, the CSAV and SAV have gradually become scientific institutions where we develop at the individual worksites and in scientific associations basic research in a wide spectrum of specialized sciences which unites within the CSAV and SAV the best qualified specialists in the individual scientific disciplines. The focal point of the academies' social mission rests primarily in the advancement of basic research which in its extent, content and quality reflects the needs of our socialist state. We consistently fulfill the scientific research and organizational tasks set forth for our science in the international division of labor within the partnership of the countries of the socialist community, ensure flexible links of our science with world science, and create conditions for the achievements of world science to become as quickly as possible a part of the consciousness, thinking and action of all our scientists and specialists. An important part of the academy's mission, especially today, is an active share in the effort of our society toward effective application of scientific findings in production, planning and management toward progress throughout our socialist society.

[Question] How would you characterize the current state of achievement in the SAV?

[Answer] The SAV is an organic component of the CSAV. Currently it has more than 4,500 employees, which represents about 30 percent of all CSAV personnel. Of these 4,500 plus, 1,129 are scientists, i.e., people with academic titles of doctor or candidate of sciences. The SAV scientific institutions are divided into three sections. The section for mathematical, physical and technical Earth and cosmic sciences has 1 center (combining 3 worksites) and 12 other scientific worksites. The section for chemical, biological and agricultural sciences has 3 scientific centers (combining 11 worksites) and 5 other worksites. The section for social sciences has 14 scientific worksites.

The focal point of the SAV research base is located in Bratislava (77 percent of the SAV staff), while 9.7 percent are in the West Slovak Kraj, 1.8 percent in the Central Slovak Kraj, and 11.5 percent in the Eastern Slovak Kraj. At the scientific worksites of the SAV and institutions of higher learning throughout Slovakia, we conduct basic research in practically all specialized sciences which need to be developed in our socialist society.

The SAV, as a learned association, currently has 91 members, of whom 36 are academicians, and 55 corresponding members; 58 of them are simultaneously members of the CSAV.

[Question] How would you assess the scientific results achieved to date by the SAV?

[Answer] We have had success in the sphere of mathematics, both in scientific orientation and theory of real functions and algebraic methods, graphs and automation. We have achieved valuable results and rich experimental data in the sphere of cybernetics, ultrahigh-conductivity, microelectronics, optoelectronics, and in research in amorphous metal materials. These were used in the production of the RPP-16 third-generation computer, in ultrahigh-conductivity magnets, integrated circuits, and elsewhere. High quality has also been achieved in research on composite metal materials on the aluminum base, and work on construction systems with the application of the latest findings on the structure of construction materials. We have achieved a solid base in scientific research in astronomy, geophysics, geology, geography, as well as in hydrology and hydraulics. In chemical sciences, we had important results in saccharide, silicate and macromolecular chemistry, with special emphasis on exploitation of the domestic raw-material base. Many of the above processes have already been applied in production and have proven highly beneficial to our national economy. At biological and medical worksites, we have successfully mastered progressive methods of research in the area of virology, encology, molecular biology and genetics, general physiology and neurophysiology, endocrinology, pharmacology, and experimental surgery. Also progressing well is ecological research, work in the physiology of farm animals, in

helmintology, dendrobiology, phytopathology and entomology. Here too, the beneficial effect of achievements in these disciplines on the national economy has been remarkable.

Our collectives have for years now been achieving generally recognized results in their participation in important international programs, such as the INTERKOSMOS project, the program of the Joint Institute for Nuclear Research in Dubna, and others. Among the creative works of the social sciences institutes are several important publications in the sphere of philosophy and sociology, economics, pedagogy and psychology, archeology, history of the European socialist countries, history of our own nation, its literature, peoples culture, linguistics... Special credit goes to the SAV for enriching Slovak national culture by such significant works as the Slovak Encyclopedia, Slovak Atlas, Geobotanic Map of Slovakia, Slovak Dictionary, Slovak-Russian Dictionary, Slovak Gazetteer, and others. The scientific achievements of members and employees of the SAV have to date been honored by 52 Klement Gottwald State Prizes, and 33 National Prizes of the Slovak Socialist Republic. Since the establishment of the SAV, its staff has provided our national economy with more than 1,200 inventions.

[Question] What are the principal problems confronting the SAV at the present time?

[Answer] Besides the traditional sustained concern for the fulfillment of the State Plan for Basic Research, we currently devote great attention primarily to the problems of integrating science and production. Many measures have been adopted which are being implemented through a concentration of research capacities, application of a targeted programmatic approach to the resolution of scientific and technological problems, formulation of the scientific program for the worksites, and creating effective links between SAV institutions and the production sphere. Great attention is also focused on ensuring our tasks in resolving the targeted projects of basic research. Of the 19 state-targeted projects of basic research which have been formulated by the CSAV, the SAV is responsible for 6. These are, for example, robot technology processing systems, complex utilization of lignocellulose raw materials, phytomass, integrated protection of plants, ecological optimization in the use of the East Slovak lowlands, and others.

Much effort is needed to build an implementation base in some of the SAV installations which would enable us to ensure a high degree of availability of scientific findings and their application in industry. For example, we are restructuring the SAV Institute for Technical Cybernetics into a scientific production unit, creating conditions for experimental production in the SAV Center for Electrophysical Research, Center for Chemical Research, and the Institute for Molecular Biology...

We also assign great significance to the establishment of detached sections of our worksites in certain production enterprises, for example, in the Piestany Tesla and the Martin ZTS. We are getting ready to master

the tasks which will be assigned the SAV in the elaboration of long-term prognoses of scientific and technological development in our society.

Even a Virus Can Be Tamed

The SAV Virological Institute was first established on a statewide basis and was part of the CSAV. Following the institution of the Czechoslovak federation, it became part of the SAV. It is one of its largest institutes with 200 employees, of which 60 hold university degrees. There are 8 doctors of sciences, 26 candidates of sciences, 2 professors, 1 academician, 2 CSAV and SAV corresponding members and several candidate members. We discussed the mission and work of the institute with its director, Prof Ladislav Borecky, corresponding member of both academies.

"Even at the time our institute was established, antibiotics were known as an effective treatment of diseases stemming from infectious agents (bacteria or mildew). Our institute focused on viruses which in peoples' subconscious are known as infectious agents. There are a great many of these and can cause 500 different ailments in a human organism. However, they also attack animals and plants in the same manner as other infectious agents. The first to discover the virus was a Russian scientist Ivanovski while studying diseased tobacco leaves.

"The virus is basically genetic material which only comes to life in a cell from which it receives its information code. We study the viruses, since if we intend to fight against something, we must get to know it first.

"Here we encounter great problems in searching for antidotes. So far, we must admit that an effective one has not yet been found. The problem is not unlike that encountered in the search for medication against tumors. Since, as we already mentioned, a virus only comes to life through contact with a cell, the main problem at this point is how to destroy the virus without destroying the cell as well. A certain degree of success was achieved at our institute in tests with interferon, which is a powerful cell regulator. In its study, there have been some advances. We were among the first to acquire it in a highly purified form and we were also able to ascertain that in cancer in animals, one of the first substances formed is interferon. Moreover, some success has been achieved with dual-fiber ribonucleous acid which causes the formation of interferon in a patient.

"The virus research enabled us to develop most modern directions in biology, molecular biology, and their study helped us to understand genetic regulation.

"Our institute conducts basic research which, as is common knowledge, does not produce rapid, palpable results. Nevertheless, what we have discovered is known throughout the world. We have advanced not only in theory but also in practice. Of great merit is, for example, the testing of medications, or the ecological research of viruses. We have prepared

a map showing the appearance of viruses transported into Slovakia by caterpillars. We have two worksites which actually assist us in practice. They are the chair of virology and microbiology of the school of natural sciences at Komensky University [UK], which breeds 'virus young,' and a joint worksite for research in vironeuroses, with the participation of the school of medicine at UK, the City Institute for National Health in Bratislava, and our institute. The results of this joint research reach directly into the sphere of health care. We even have contacts with the medical schools, breeding stations and other research institutions. Moreover, within the institute we have three reference centers of the WHO which have an educational mission. One is for rickets-type diseases, the second for encephalitis, and the third for research of viral etiology of psychic diseases.

"Relatively new is the section for medical virology. It has been in existence only 2 years as part of the Infectious and Parasitic Diseases Clinic of the UK Medical School in Bratislava. It undertakes research of neuroviruses and assists in diagnosing certain rare diseases. In addition, we have a laboratory of comparative virology which studies the relationship between viruses in humans and animals. This worksite is headed by Academician Dionys Blaskovic.

"By the end of the 5-year plan, we should have a new institute. Housing problems should not be an obstacle in continuing the important research work in this rapidly developing branch of biology."

A Place of Deep Secrets

The hallway of the SAV Physics Institute in Bratislava leaves a strange, if not icy impression. Locked in by a gate at each end and creating an eerie feeling of long-term refrigeration of life which one encounters in science-fiction literature, it leads to the office door of a dedicated scientist, Eng Pavol Duhaj, Candidate of Sciences. He greeted us with a friendly smile and immediately took us quite willingly to a laboratory which has an aura of magic about it, the laboratory of amorphous metal alloys.

Their advantage is that they can be shaped in molten state into strips of different width and thickness for now, several hundred, in the future perhaps several thousand meters. This technology significantly reduces production cost in comparison with the classical method of using materials in which it was necessary to melt the metal, pour it off in a casting and then roll it several times. Amorphous metals have special physical properties, especially magnetic and mechanical, and are also rust resistant. What exactly do we need them for? In the electrotechnical industry they are used as nuclei of transformers, recorder heads, magnetic tape and many other types of equipment. With the new technology it is possible to produce hard braziers at temperatures of about 900 degrees Celcius. They are very tough and rust resistant. Up to now, brazing of the necessary chemical composition could be done only in the form of a powder. With the technology of rapid cooling, such brazing of the desired composition can be accomplished in the form of strips, which is much better

for the brazing technology. "It is only too bad we cannot find a producer for them in this country. Even though we would be willing to help any production enterprise at the beginning, it looks as though we will have to manufacture them ourselves right here at this worksite." This, as he was saying goodbye to us, from Engineer Duhaj, leader of a three-member collective of scientists who have recently been awarded a SAV prize precisely for advancing production technology and research of the physical properties of amorphous metal materials.

The Physics Institute which we have just seen is part of the SAV Center for Electrophysics Research which also incorporates the Electrotechnical Institute and the Institute for Measurement and Measuring Technology. The center began its work on 1 January 1981 and focuses on the realization of scientific programs important for developing knowledge but also for social development, especially with respect to practical application of this knowledge in production. The scientific performance capacity of the center was concentrated on a rather small area of scientific problems in three focal spheres, namely, research on new materials, structures and elements for microelectronics and optoelectronics, research in amorphous alloys and ultrahigh-conductivity materials, and finally automation of scientific experiments.

The center is setting up an implementation section which will produce unique materials, electronic elements and equipment. We should mention small series and unit production of optoelectrical linkage elements, the Hall probes, ultrahigh-conductivity quantum magnetometer, magnetometer with the Hall probe, samples of the already mentioned amorphous metal alloys, a feeder generator for plasma chemical technology... Most of the achievements have been made possible thanks to a highly developed initiative of the workers and brigades of socialist labor which should be considered an important factor in the performance of the center's institutes.

Assessment of the work and basic concepts of the CSAV has been included in reports of party congresses from the 14th to the 16th. The role of science is, of course, also understood by the leading experts in the field themselves, as expressed in the following statement: "Strategy of its development has ceased to be a specific side issue, on the contrary, it has become one of the determining factors in the future development of our society."

The entry of our science in the integration process of the socialist countries has also been dealt with by CPCZ General Secretary Gustav Husak who stated the following from the platform of the 16th CPCZ Congress: "International cooperation in science, especially with Soviet scientists, has brought us significant successes. In this connection, we should recall at least cosmic and nuclear research, research in molecular genetics, as well as the effort to bring theoretical treatment of the experiences from the struggle for real socialism closer to the people.

"Despite unquestionable achievements, we must note that the rate of progress and practical application of science does not reflect the needs which confront us. Little has been done to date toward the concentration of forces in resolving the key problems of our society.

"Scientific research must be still more emphatically oriented toward acquisition of fresh resources for our energy needs, for better utilization of the raw-material base, and valorization of materials suitable for electronics, cybernetics, robot technology, probing biological technologies, enhancing the fertility of the soil and utility of farm animals, and for the protection of the environment.

"Among the most important tasks in the sphere of social sciences in the next 5-year plan will be the examination of the timely problem of the building of a developed socialist society in Czechoslovakia. The advances in social sciences cannot do without creative discussion in a critical atmosphere, without bold probing of the new, and especially without a principled party approach.

"Practical experience has shown that it is most essential to assess the present system of management in science and technology. Elaboration of a system which ensures a unified national policy in the sphere of science and technology will lead to a much-needed more intensified linkage of science and production, and will raise our scientific and technological base to a higher level."

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CZECHOSLOVAK ACADEMY OF SCIENCES DESCRIBED

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[Article: "Organization: Czechoslovak Academy of Sciences"]

[Text] Headquarters

Prague

Status

The Czechoslovak Academy of Sciences [CSAV] is the highest scientific institution in the Czechoslovak Socialist Republic; it develops research activity in its scientific centers and brings together foremost scientific workers as its members. It was established under Law No 52/1952 of SBIRKA dated 29 October 1952 which became effective 12 November 1952. The law on the CSAV has been amended several times. Law No 53/1957 of SBIRKA dated 31 October 1957 gave the CSAV new duties and authority. According to the amended law, the CSAV Seventh General Assembly adopted the CSAV bylaws setting up in detail its internal relations. Changes in the state, especially following adoption of the new socialist constitution, required another amendment of the CSAV law, specifically Law No 54/1963 of 9 July 1963. This law was supplemented by legal measure No 26/1970 of SBIRKA of the CSSR Federal Assembly Presidium on 19 March 1970. The last amendment of the law took place in 1977. On 15 December 1977, Law No 91/1977 of SBIRKA on the Czechoslovak Academy of Sciences was promulgated and it is the fundamental legal thesis of the CSAV.

Operations

The chief functions of the CSAV are research work and managing and coordinating activity in basic research. The CSAV produces overall concepts of development of science in Czechoslovakia in accordance with the requirements of the expanding socialist society. On the highest level, it develops scientific research activity on the most important prospective economic and social projects in the natural, social and technical sciences. It concentrates on coordinating the scientific and methodological activities of all scientific work centers and universities in the area of basic

research. It seeks out and trains highly qualified science workers for the requirements of scientific work centers and for practical needs, especially in cooperation with universities. It publishes the results of its activities and helps popularize the results of scientific research. The CSAV is the chief representative of Czechoslovak science abroad. It organizes and coordinates scientific relations with academies of science and similar institutions abroad, especially with the academies of science of socialist countries. In basic scientific questions, the CSAV is the chief adviser and coordinator of party and government bodies. It prepares the proposal for long-range research programs of Czechoslovak science and also proposals of statewide plans of fundamental scientific research activity and monitors fulfillment of these plans. The scientific activity of the CSAV is coordinated with the national plan of basic research, which is a constituent part of the national plan for science and technology approved by the CSSR Government. The Government of the CSSR has entrusted the CSAV with the elaboration of these basic research programs and thereby the CSAV took over the role of responsible guarantor for the entire field of basic research. The national programs of basic research encompass in their subject matter most of the areas of basic research (I. Physical properties of matter, its structure, methods of current mathematics; II. The cosmic world, the Earth and utilization of its resources; III. New theoretical bases of technology; IV. New chemical processes, their control and technology; V. Structure and function of organic matter; VI. Man and the biosphere; VII. Biological and medical sciences, healthy development of man; VIII. Socialist society during the scientific-technical revolution).

Czechoslovak scientific work centers have achieved many significant results which have been recognized and appreciated home and abroad. For example, the CSSR achieved world standard results in research on semiconductors and magnetic and dialytic substances. Research in the field of cosmic technology brought about valuable results under the Interkosmos international program. In astronomy as well, significant theoretical results were achieved in research on solar activity, interplanetary matter and explaining the physical processes in the interior of stars. In the field of macromolecular chemistry, developments in hydrophilic gels mean overcoming conservatism in the application of synthetic substances in medicine. Among the most important results achieved in biochemistry, the preparation of analogs of neurohypophysial hormones must be mentioned. The main genetic system of transplant toleration in man was discovered and the evidence of its similarity to corresponding systems in other kinds of animals, including common laboratory ones. The results from this kind of special biological work were especially helpful in the area of helminthological and parasitological research in our veterinary and agricultural practices. Unusual results were achieved recently in the field of molecular biology and genetic engineering. We also gained important results in the area of the social sciences and historical sciences. Many of the results achieved in CSAV work centers were developed and applied directly in social practices.

To further develop basic research the cooperation and mutual assistance among research centers of the academies of socialist countries is very important, especially cooperation of the CSAV with the USSR Academy of Sciences. The cooperation of the CSAV and its work centers in scientific programs within CEMA is increasingly important. The CSAV is optimally involved with the process of socialist integration in science and it utilizes its foreign contacts for close cooperation in the long-term plans of research and development in the countries of the socialist community. It also cooperates with many scientific institutions in developed capitalist nations. The CSAV is an active member in international governmental and nongovernmental organizations. Its work, for example, with the scientific programs of UNESCO is important. The CSAV is also involved in the programs and operations of the WHO.

History

The CSAV is part of the progressive tradition of Czech and Slovak science. It emerged in the awakening of national scientific institutions, that is, the Royal Czech Society of Learning, the Czech Academy of Science and Arts, the Slovak Matica [Cultural Institute] and the Slovak Academy of Science and Arts. The Royal Czech Society of Learning was the oldest scientific society in Bohemia. It was established in the years 1770-1771 originally as the Private Society of Learning. In 1784, it attained public recognition through a court decree and was named the Czech Society of Learning. In 1790, it took the name Royal Czech Society of Learning. Its objective was to arrange meetings with lectures and with experimental exhibits of the work of members, offer awards for dissertations on designated topics, give reviews and publish scientific works.

The Czech Academy of Science and Arts was established in 1890 from a financial gift of the architect J. Hlavka. Its purpose was to support scientific activity, watch over the Czech language and literature and improve the domestic arts, disseminate works in the Czech language and also the results of scientific, literary and artistic works published in other languages.

In bourgeois Czechoslovakia, the scientific base was fragmented and uncoordinated and without any significant state support. Basic research was associated with industrial enterprises and their requirements. Only with establishment of the people's democratic state did science begin to develop in the interests of the national economy and all of society. The era of building the foundations of socialism brought new opportunities for the development of science in Czechoslovakia, in fact it was placed before new tasks which the national economy and social practices imposed. In addition, it took on the responsibility of catching up with global scientific-technical advances both quantitatively and qualitatively and securing a place for Czechoslovak science commensurate with the development of our productive forces and traditions of scientific investigation. There arose the need to build scientific institutions of modern types, institutions with scientifically planned research, assured of interdepartmental cooperation and closely connected with the work centers of applied research and procedures. Thus emerged the Czechoslovak Academy of Sciences based on the law of 29 October 1952. At its establishment many older

scientific institutions, institutes, foundations and endowments were incorporated with it (especially seven centralized natural scientific institutes: biological, chemical, physical, geological, mathematical, polarographical and astronomical and also the Slavic Institute, the Oriental Institute and others), and at the same time the CSAV began to set up its own network of new work centers for basic scientific research. In 1953, an analogous institution originated in Slovakia--the Slovak Academy of Sciences (SAV). In the interests of consolidating the organization and management of all science in Czechoslovakia, in 1960 the SAV was also organically incorporated into the CSAV and so became--while retaining its name--an integral part of the CSAV.

Structure

The general assembly of CSAV members is the supreme organ of the CSAV. It makes decisions on basic organizational questions, determines the main directions of CSAV activity and its future development. As proposed by the CSAV presidium, it elects members to the CSAV and the members of the CSAV presidium (the presidium submits results of the elections as proposals to the CSSR Government). The general assembly meets as a rule once a year; the CSAV presidium convenes it.

The CSAV president stands at the head of the CSAV. The president of the CSSR, on the proposal of the government, appoints him from the ranks of the academicians and recalls him. The president of the CSAV consistently oversees fulfillment of the CSAV objectives; he is responsible for performance of his duties to the CSSR Government.

The CSAV presidium is the central managing body of the CSAV. The presidium is responsible to the CSSR Government for operation of the CSAV. The members of the presidium are the CSAV president, the CSAV vice presidents, other presidium members and the CSAV scientific secretary. The presidium members are appointed and recalled by the CSSR Government, as a rule on the basis of election by members of the CSAV general assembly. The term of office of the presidium is 5 years.

CSAV president	Academician Bohumil Kvasil
CSAV vice presidents	Academician Vladimir Hajko
	Academician Vladimir Pokorny
	Academician Premysl Rys
	Academician Josef Riman
	Academician Zdenek Snitil

The basic ideological and scientific bodies of the CSAV for individual scientific subjects are the scientific collegia of the CSAV. Centers for scientific research activities of the CSAV are their scientific work centers.

The CSAV objectives in the administrative-managerial and organizational area are provided by the CSAV staff.

Membership

Members of the CSAV are appointed by the CSSR Government on the basis of elections, as a rule, which are conducted by the general assembly of the CSAV membership or on proposals of the CSAV presidium. Membership in the CSAV consists of line member-academicians, corresponding members and foreign and honorary members.

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CSO: 2402/10

RESEARCH-DEVELOPMENT PROCESS, PROGRAMS OUTLINED

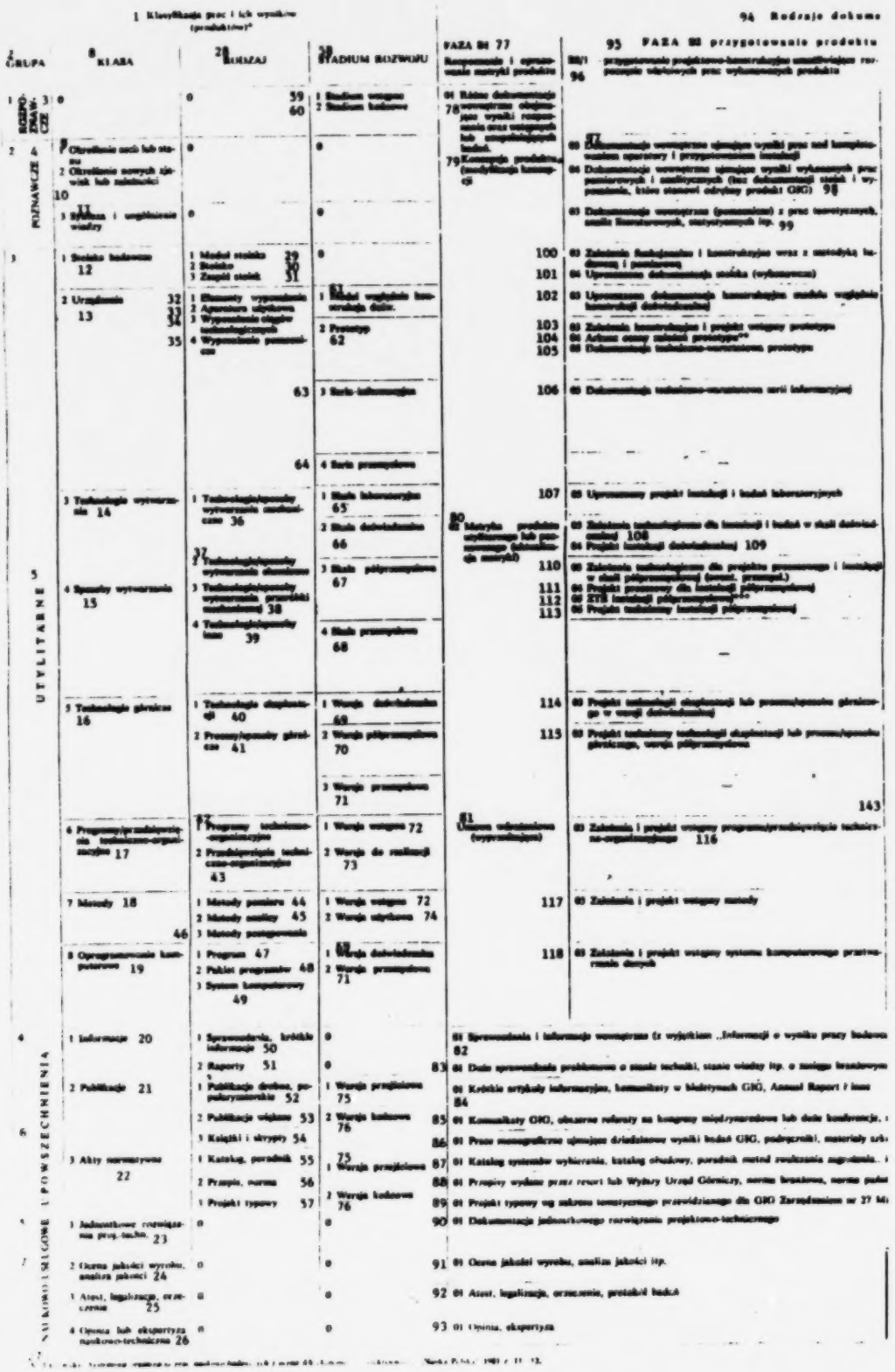
Organization of Process

Warsaw NAUKA POLSKA in Polish No 11-12, Nov-Dec 81 /Insert/

[Text] Table 1. Organization of the Research and Development Process In The GIG [Main Institute of Mining]

Key:

1. Classification of work and its results (products)
2. Group
3. Examination
4. Determination
5. Utility
6. Dissemination
7. Science-Service
8. Class
9. Determining its features or state
10. Determining new phenomena or dependence
11. Synthesis and generalizing knowledge
12. Test bench


1 Klasyfikacja prac i ich wyników (produktów)*
94 Rodzaje dokume
2 GRUPA
8 KLASA
28 RODZAJ
29 STADIUM ROZWOJU
FAZA BI 77
Rozpoznanie i sprecyzowanie materiału produktu
95 FAZA BII przygotowanie produktu
BII/1 przygotowanie projektowo-konstrukcyjne umożliwiające rozpoczęcie właściwych prac wykonawczych produktu
96
1 BADAWCZO-ROZWOJOWE
2 POZNAWCZE
3 UTYLITARNE
4 NAUKOWO-TECHNICZNE I POWSZECHNIENIA
1 Środki trwałe 12
2 Urządzenia 13
3 Technologie wytwarzania 14
4 Sposoby wytwarzania 15
5 Technologia gleb 16
6 Programy (algorytmy) technologiczno-organizacyjne 17
7 Metody 18
8 Oprogramowanie komputerowe 19
1 Informacje 20
2 Publikacje 21
3 Akty normatywne 22
1 Jednostkowe rozwiązania proj.-techn. 23
2 Ocena jakości wyrobu, analiza jakości 24
3 Atest, legalizacja, orzeczenie 25
4 Opinia lub ekspertyza naukowo-techniczna 26
1 Środki trwałe 59 60
2 Środki obrotowe 29 30 31
3 Zespół środków 61
1 Elementy wyposażenia 32
2 Aparatura użytkowa 33
3 Wyposażenie ciągów technologicznych 34
4 Wyposażenie pomocnicze 35
1 Technologie/sposoby wytwarzania modułowe 36
2 Technologie/sposoby wytwarzania złożone 37
3 Technologie/sposoby wytwarzania prostsze modułowe 38
4 Technologie/sposoby inne 39
1 Technologia eksploatacji 40
2 Procesy/sposoby gleboznawcze 41
1 Programy techniczno-organizacyjne 42
2 Przedsięwzięcia techniczno-organizacyjne 43
1 Metody pomiaru 44
2 Metody analizy 45
3 Metody postępowania 46
1 Program 47
2 Pakiet programów 48
3 System komputerowy 49
1 Sprawozdania, krótkie informacje 50
2 Raporty 51
1 Publikacje druków. popularyzatorskie 52
2 Publikacje większe 53
3 Książki i skrypty 54
1 Katalog, poradnik 55
2 Przepis, norma 56
3 Projekt typowy 57
1 Studium wstępne
2 Studium końcowe
1 Model wstępny 62
2 Prototyp 62
3 Serie informacyjne 63
4 Serie przemysłowe 64
1 Serie laboratoryjne 65
2 Serie doświadczalne 66
3 Serie półprzemysłowe 67
4 Serie przemysłowe 68
1 Wersja doświadczalna 69
2 Wersja półprzemysłowa 70
3 Wersja przemysłowa 71
1 Wersja wstępna 72
2 Wersja do realizacji 73
1 Wersja wstępna 72
2 Wersja ulepszona 74
1 Wersja doświadczalna 69
2 Wersja przemysłowa 71
1 Wersja projektowa 75
2 Wersja końcowa 76
1 Wersja projektowa 75
2 Wersja końcowa 76
0
0
0

stacji przewidziano dla poszczególnych stadiów i faz procesu badań i rozwoju*

do fazy sprawdzenia w warunkach przemysłowych

B2.2 — właściwe prace wykonawcze poprzedzające do powstania produktu oraz badania umożliwiające wprowadzenie go do fazy R 119

05 Dokumentacja ujmujące wyniki badań przygotowane w formie dostosowanej do merytorycznej charakterystyki produkcji i sprzyjającej ich praktycznemu wykorzystaniu (bez fazy R) np. prace magisterskie o rozpoznaniu zlec, prace doktorskie lub równoważne itp. 120

04 Dokumentacja ujmujące wyniki badań przygotowywane w formie sprzyjającej upowszechnieniu opracowywanego ugruntowania wiedzy (bez fazy R) w tym maszynopisy przygotowywanych monografii, skryptów, prace habilitacyjne itp. 121

05 Dokumentacja techniczno-robocza stanka (powykonawcza) 122
06 Instrukcja obsługi i użytkowania stanka 123
07 Protokół odbioru warsztatowego 124

04 Wyniki prób i badań modelu względnie konstrukcji doświadczalnej 125

06 Dokumentacja techniczno-warsztatowa powykonawcza (kopia z poprawkami naniesionymi w czasie wykonywania prototypu) 126
07 Instrukcja użytkowania i obsługi prototypu (korygowana po fazie R) 127
08 Protokół odbioru prototypu wraz z wynikami rozruchu warsztatowego i decyzją o dopuszczeniu do fazy R 128

04 Dokumentacja techniczno-warsztatowa powykonawcza (kopia z poprawkami naniesionymi w czasie wykonywania serii informacyjnej) 129
05 Instrukcja użytkowania i obsługi serii informacyjnej wyrobu 130

01 Dokumentacja techniczno-warsztatowa serii przemysłowej 131
04 Instrukcje użytkowania i obsługi serii przemysłowej 132

04 Wyniki badań w skali laboratoryjnej i ich analiza (wraz z ewentualną koncepcją technologiczną) 133

05 Analiza i opracowanie wyników badań w skali doświadczalnej 134

07 Protokół odbioru instalacji półprzemysłowej wraz z wynikami rozruchu i decyzją o dopuszczeniu do fazy R 135

03 Założenia technologiczne dla projektu przemysłowego instalacji przemysłowej (zakładu) 136
04 Projekt procesowy dla instalacji przemysłowej 137
05 ZTE instalacji przemysłowej (zakładu) 138
06 Projekt techniczny instalacji przemysłowej 139

04 Dokumentacja wykonawcza przygotowująca próby serii doświadczalnej 140

04 Dokumentacja dopuszczeniowa technologii eksploatacji lub procesu/sposobu górniczego w wersji półprzemysłowej 141

03 Projekt technologii eksploatacji lub procesu/sposobu górniczego w wersji przemysłowej (opis wraz z instrukcją stosowania) 142
04 Dokumentacja dopuszczeniowa technologii eksploatacji lub procesu/sposobu górniczego

04 Projekt techniczny programu/przedsięwzięcia techniczno-organizacyjnego wraz z zasadami i instrukcją realizacji — wersja do fazy R 144

04 Opis metody wraz z wytycznymi instrukcją stosowania — wersja do fazy R 145

146

04 Dokumenty źródłowe wraz z instrukcją ich sporządzania i korygowania — wersja do fazy R
05 Organizacja i schemat przetwarzania (charakterystyka zbiorów i algorytmy) 147
06 Dokumentacja oprogramowania komputerowego wraz z wynikami testowania i instrukcja eksploatacji — wersja do fazy R 148
07 Arkusze wynikowe wraz z zasadami tworzenia i wykorzystania — wersja do fazy R 149

ej")

i lub szerszym

artykuły problemowe w czasopismach itp

ołnione o charakterystyce skrypt

itp

twowe itp

nistra Górnictwa z dn. 25.09.1979 (Znak fa-BP/1494)

** — tylko w przypadkach określonych Zarządzeniem nr 21 Ministra Górnictwa z dnia 11.07.1979 r. (znak FM 9) 1564/79 150
*** — prawo do wynagrodzenia przez inwestora 151

FAZA R — Sprawdzenie produktu w warunkach przemysłowego stosowania (lub w warunkach ewidentnych) oraz uzyskanie oceny i dopuszczeń warunkujących wdrożenie 152

08 Wyniki rozruchu i próbnej eksploatacji 153
09 Informacja o wyniku pracy badawczej 154

09 Wyniki badania prototypu w fazie R w warunkach przemysłowych 155
10 Dokumentacja techniczno-warsztatowa prototypu (z poprawkami na kopii naniesionymi w wyniku fazy R) 156
11 Arkusz oceny wyrobu (produktu)** 157
Umowa wdrożeniowa 158

06 Wyniki badania serii informacyjnej w warunkach przemysłowych 159
07 Dokumentacja techniczno-warsztatowa serii informacyjnej (kopia z poprawkami naniesionymi po badaniach przemysłowych) 160
08 Arkusz oceny wyrobu dla dopuszczenia do produkcji przemysłowej 161
09 Informacja o wyniku pracy badawczej 154
Umowa wdrożeniowa 158

05 Protokół uruchomienia produkcji przemysłowej 162
Umowa wdrożeniowa 158

06 Dokumentacja osób jakościowych technologii i wyrobu w skali doświadczalnej 163
Umowa wdrożeniowa 158

08 Powykonawczy projekt technologii instalacji półprzemysłowej 164
09 Projekt procesowy w skali półprzemysłowej w fazie R 165
10 Wymagania technologiczne produktu 166
11 Informacja o wyniku pracy badawczej 154
Umowa wdrożeniowa 158

07 Analiza i opracowanie wyników fazy rozruchu procesu technologicznego skali przemysłowej wraz z dokumentacją zmian w procesie i instalacji 167
08 Wymagania technologiczne produktu w skali przemysłowej 168
09 Opis technologiczny procesu w skali przemysłowej 169
10 Protokół uruchomienia produkcji przemysłowej 162
Umowa wdrożeniowa 158

09 Wyniki prób wersji doświadczalnej, technologii eksploatacji lub przemysłowego górniczego wraz z ewentualną koncepcją nowego wypracowania technologicznego 170

05 Wyniki stosowania w fazie R (technologii eksploatacji lub procesu) sposobu górniczego w wersji półprzemysłowej wraz z oceną 171
06 Informacja o wyniku pracy badawczej 154
Umowa wdrożeniowa 158

05 Wyniki przemysłowego stosowania w fazie R (technologii eksploatacji lub procesu) sposobu górniczego 172
Umowa wdrożeniowa 158

05 Wyniki przemysłowej weryfikacji programu/przedsięwzięcia techniczno-organizacyjnego wraz z jego oceną 173
06 Projekt programu/przedsięwzięcia techniczno-organizacyjnego wraz z zasadami i instrukcją stosowania 174
07 Informacja o wyniku pracy badawczej 154
Umowa wdrożeniowa 158

05 Wyniki stosowania metody wraz z jej oceną po fazie R 175
06 Opis metody wraz z wytycznymi/instrukcją stosowania po weryfikacji w fazie R 176
07 Informacja o wyniku pracy badawczej 154
Umowa wdrożeniowa 158

08 Dokumenty źródłowe wraz z instrukcją sporządzania i korygowania po weryfikacji w fazie R 177
09 Dokumentacja oprogramowania komputerowego wraz z wynikami testowań przemysłowych i instrukcja stosowania po weryfikacji w fazie R 178
10 Arkusze wynikowe wraz z zasadami tworzenia i wykorzystania po weryfikacji 179
11 Technologia przetwarzania w ośrodkach obliczeniowych 180
12 Informacja o wyniku pracy badawczej 154
Umowa wdrożeniowa 158

Oznaczenia 181

* liczby arabskie oznaczają elementy klasyfikacyjnego kodu produktów i dokumentacji 182
– symbol „0" przyporządkowany opisanym pozom tablicy klasyfikacyjnej oznacza, że cechy określone tymi pozami nie są identyfikowane 183
– kody klasyfikacyjne tworzy się wg następującej zasady: 184

2 grupa
8 klasa
28 rodzaj
58 stadium rozwoju
185 numer w dokumentacji

186 kod produktu niezmienny
kod produktu z uwzględnieniem stadium rozwoju 187
kod dokumentacji 188

Przykłady tworzenia kodu: 189
Produkt zaliczony do grupy 3 w tym klasie 2 rodzaj 3 stadium rozwoju 4 otrzymuje kod niezmienny 3 2 3
kod z uwzględnieniem stadium rozwoju 3 2 3 4

190 Dokumentacja dla tego produktu wykonana w fazie B2.2 wymieniona pod numerem 04 otrzymuje kod 3 2 3 4 04

13. Equipment
14. Manufacturing technology
15. Production methods
16. Mining technology
17. Technical-Organizational programs/projects
18. Methods
19. Computer software
20. Information
21. Publications
22. Standards
23. Singular design-technical solutions
24. Evaluation of product quality, analysis of quality
25. Attestation, legalization, judgment
26. Opinion or professional scientific-technical report
27. Lisowski: "Systematic Organization of Scientific Research Work and an Evaluation of Its Economic Effectiveness," NAUKA POLSKA, 1981, pp 11-12
28. Type
29. Stand module
30. Stand
31. Group of stands
32. Equipment components
33. Useful apparatus
34. Production flow-lines equipment
35. Auxiliary equipment
36. Technology/methods of mechanical production
37. Technology/methods of chemical production
38. Technology/methods of mechanical modifications
39. Other technology/methods
40. Technology of exploitation
41. Mining processes/methods
42. Technical-organizational programs
43. Technical-organizational projects
44. Measuring methods
45. Methods of analysis
46. Methods of procedure
47. Program
48. Packet of programs
49. Computer system
50. Reports, short references
51. Reports
52. Small publications, popularizing publications
53. Larger publications
54. Books and scripts
55. Catalogs, handbook
56. Regulations, standards
57. Typical project
58. Stage of development
59. Initial stage
60. Final stage
61. Model relative to experimental design

62. Prototype
63. Series-informational
64. Industrial series
65. Laboratory scale
66. Experimental scale
67. Semi-industrial scale
68. Industrial scale
69. Experimental version
70. Semi-industrial version
71. Industrial version
72. Initial version
73. Version to be implemented
74. Useful version
75. Interim version
76. Final version
77. Phase B1--Examination and preparation of product specifications
78. Various internal documentation showing examination results and initial or supplemental research
79. Product conception (concept modification)
80. Specifications of a utility or determination product (actualizing specifications)
81. Contract for application (leadtime)
82. Reports and internal information (except "Information Concerning Research Work")
83. Large problem-type reports on the state of technology, know-how and so forth on a branch or wider scale
84. Short informational articles and announcements in GIG bulletins, annual reports and others
85. GIG announcements, comprehensive papers at international congresses or large conferences, problem-type articles in magazines
86. Monographs encompassing GIG research results for various branches, textbooks, script-type training material
87. Catalog of selection systems, housing catalog, handbook of methods to combat threats and the like
88. Regulations issued by the ministry or the Higher Mining Office, branch standards, state standards and the like
89. Standard project according to thematic range projected by the GIG by Order No 27 of the Ministry of Mining of 25 September 1979 (seal In-BP/1494)
90. Documentation of individual design-technical solutions
91. Evaluation of product quality, analysis of quality and so forth
92. Attestation, legalization, judgment, research protocols
93. Opinions, professional report
94. Phase B2--Preparation of product for phase testing under industrial conditions.
96. Design-construction preparations permitting the initiation of suitable executory work on the product
97. Internal documentation encompassing work results on completing the apparatus and preparing the installation

98. Internal documentation encompassing results of executed measurement and analytic work (without equipment and test-stand documentation which is a separate GIG product)
99. Internal documentation (ancillary) of theoretical work, literature and theoretical analyses and the like
100. Functional and design principles together with research and measuring methodology
101. Simplified bench documentation (work)
102. Simplified design documentation of the model with regard to experimental design
103. Design and construction assumptions of the first prototype
104. Sheet on the evaluation of prototype assumptions
105. Technical-workshop documentation of prototype
106. Technical-workshop documentation of informational series
107. Simplified installation design and laboratory research
108. Technological assumptions for the installation and research on an experimental scale
109. Experimental installation design
110. Technological assumptions for the processing and installation design on a semi-industrial scale (possibly industrial scale)
111. Process design for semi-industrial installation
112. ZTE [Technical-Economic Guidelines] semi-industrial installation
113. Technical design of semi-industrial installation
114. Design of operation technology or mining process/method, experimental version
115. Design of operation technology or mining process/method, semi-industrial version
116. Assumptions and initial design of technical/organizational program/ project
117. Assumptions and initial design of methods
118. Assumptions and initial design of data processing system
119. Actual completion work leading to the creation of a product and research leading it to phase R [development]
120. Documentation encompassing research results prepared in a form suitable for the essential production characteristics and promoting their practical use (without phase R), for example, monographs on survey of deposits, doctoral or equivalent work and the like
121. Documentation encompassing research results prepared in a form to promote the dissemination of the prepared generalizations of know-how (without phase R), including typewritten monographs, scripts, assistant professorship theses and the like
122. Technical-working documentation for the bench (postcompletion)
123. Instructions for servicing and using the bench
124. Protocol for receipt of workshop
125. Results of tests and investigations of model relative to experimental design
126. Postcompletion technical-workshop documentation (copy with corrections written in while completing the prototype)

127. Instructions for using and servicing the prototype (corrected after phase R)
128. Protocol for the receipt of the prototype together with the workshop startup and decision regarding admittance to phase R
129. Postcompletion technical-workshop documentation (copy corrections written in while completing the informational series)
130. Instructions for using and servicing the product's informational series
131. Technical-workshop documentation for the industrial series
132. Instructions for using and servicing the industrial series
133. Results of research on a laboratory scale and their analyses (together with a conceivable technological concept)
134. Analysis and preparation of results of research on an experimental scale
135. Protocol for the receipt of a semi-industrial installation together with startup results and decision regarding admittance to phase R
136. Technological assumptions for the process design for an industrial installation (plant)
137. Process design for industrial installation
138. ZTE industrial installation (plant)
139. Technical design for industrial installation
140. Working documentation to prepare tests of the experimental series
141. Admittance documentation for operation technology or mining process/method, nonindustrial version
142. Design of operation technology or mining process/method for the industrial version (description and application instructions
143. Admittance documentation for operation technology or mining process/method
144. Technical design for technical-organizational program/project together with implementation principles and instructions--version up to phase R
145. Description of methods together with application guidelines/instructions--version up to phase R
146. Source documents together with instructions for their verification and correction--version up to phase R
147. Processing organization and scheme (characteristics of files and algorithms)
148. Computer software documentation together with test results and operating instructions--up to phase R
149. Results sheets together with principles of production and use--up to phase R
150. Only for the cases designated in Order No 21 of the Ministry of Mining of 31 July 1979 (mark EM9) 3564/79
151. If paid for by the investor
152. Phase R--Verifying the product under industrial application conditions (or under evidence conditions) and obtaining evaluations and allowances conditioning applications
153. Startup and trial operation results

154. Information on research work results
155. Results of researching prototype in phase R under industrial conditions
156. Technical-workshop documentation for prototype (with correction on copy resulting from phase R)
157. Product evaluation sheet
158. Contract for application
159. Research results for informational series under industrial conditions
160. Technical-workshop documentation for the informational series (copy with corrections made after industrial investigations)
161. Product evaluation sheet to permit industrial production
162. Protocol to initiate industrial production
163. Documentation of qualitative characteristics of the technology and product on an experimental scale
164. Postcompletion technical design for semi-industrial installation.
165. Process design on a semi-industrial scale in phase R
166. Product technical requirements
167. Analysis and preparation of phase results for the technological process on an industrial scale together with documentation of changes in the process and installation
168. Product technical requirements on an industrial scale
169. Technical description of process on an industrial scale
170. Test results of experimental version, technology of operation or mining process/method together with conceivable concept for new technical equipment
171. Application results in phase R (technology of operation or mining process/method in the semi-industrial version together with an evaluation
172. Results of industrial application in phase R (technology of operation or mining process/method)
173. Results of industrial verification of technical-organizational program/project together with its evaluation
174. Design of technical-organizational program/project together with application principles and instructions
175. Results of application of methods together with their evaluation after phase R
176. Description of methods together with application guidelines/instructions after verification in phase R
177. Source documents together with verification and correction instructions after verification in phase R
178. Computer software documentation together with results of industrial testing and application instructions after verification in phase R
179. Results sheets together with principles of production and use after verification
180. Processing technology in computer centers
181. References
182. Arabic numeral designates classification code elements for products and documentation

183. The symbol '0' next to a classification table field means that the characteristics designated by these fields are not identified.
184. Classification codes are formed per the following principles:
185. Number in documentation
186. Unalterable product code
187. Product code taking into account stage of development
188. Documentation code
189. Examples of code formation: A product in group '3,' class '2,' type '3' and stage of development '4' is given the code '323' and the code '3234' which takes into account the stage of development
190. Documentation for that product completed in phase B2/2 designated under number '4' is given the code 323404

Research-Development Application Programs

Warsaw RZECZPOSPOLITA in Polish 6 Sep 82 pp 1, 2

[Interview with Mieczyslaw Kazimierczuk, undersecretary of state of the Ministry of Science, Higher Education and Technology, by Tadeusz Podwysocki; date and place not given]

[Text] The Ministry of Science, Higher Education and Technology as well as the PAN [Polish Academy of Sciences] with the participation of coordinating teams, coreporters and advisers reviewed and verified government research and development programs, complex problems and basic research problems. Also, most programs were discussed by teams and commissions of the Main Council for Science, Higher Education and Technology.

In addition, three interministerial commissions were concerned with the verification and review of basic research. RZECZPOSPOLITA discusses the results of the review and verification with Mieczyslaw Kazimierczuk, undersecretary of state of the Ministry of Science, Higher Education and Technology.

[Question] The basis for the review and verification programs was the government operating schedule for implementing the decisions of the Ninth Extraordinary Congress of the PZPR and the operating schedule for government action presented in the Sejm (25 January 1982) by Wojciech Jaruzelski, chairman of the Council of Ministers. The results of the review and verification of the scientific research programs were considered at a meeting of the Sociopolitical Committee of the Council of Ministers.

[Answer] I will start with the basic question. Economic and cultural needs during this time period of stabilization and diminishing crisis thrust the specified goals and tasks to the fore. Consequently, the so-called large scientific research programs had to be adapted to the country's current and

most important social and economic plans. At the same time, the concern was to maintain Poland's scientific position in those areas and specific projects that are characterized as being world-level projects and achievements, those that have a future, especially for the second half of the 1980s.

[Question] Then we could say that verification is not a painful incision. How certain can we be that the review was proper? And were projects canceled that could provide many benefits for Poland and, in general, for science? The question here is one of verification criteria.

[Answer] Changes were made in research program coordination plans in accordance with designated prerequisites. They concerned eliminating or postponing until future years those projects which realistically could not be included in the 3-year plan.

Will we be able to implement an innovation requiring imported materials and subassemblies from the dollar zone? Research work whose crowning achievement would be large new investments, as well as projects not guaranteeing sufficient, significant economic and technical results were eliminated. The verification also cleansed the research programs of chance projects that were added to basic goals and tasks.

[Question] Mr Minister, could you cite some of these projects whose realization over the new few years would be unrealistic and which have not stood up to the test of time?

[Answer] Of course. But first, I will give examples of research projects that are ready for implementation or application in the economy.

[Question] Please do.

[Answer] For example, take the work on large 600-MW power units and excavators having capacities of 100,000 cubic meters per day. Also, work on underground gasification of coal and research on testing finished products from coal liquification were eliminated.

We are cutting back work on a number of machines and equipment. We eliminated the development of a new generation of R-47 computers and SM-5218 minicomputers as well as the development of large-capacity computer disc memories.

[Question] I understand; they are in reality projects that would have absorbed many millions of zlotys and foreign exchange and the results would not mitigate the crisis. You mentioned, sir, the offerings that science is availing to the economy.

[Answer] Here I must emphasize a very important point, to wit: The review and verification of the research programs means that there will be big changes in the thematic structure of advisable activities in the field of adapting science more closely to the needs of the economy. We have been very

successful in redirecting research programs to meet the needs of the country's social and economic development as designated by the government.

After the verification, 24 percent of the themes in the government research programs involve elimination or substitution of imports, and in complex problems it is over 22 percent. But work that is supposed to save fuel, energy and raw materials absorb 21.9 percent of the government program outlays and 17.7 percent of the complex problem resources. At the third level, and thus a very high level, of investing resources and potential are themes in the area of helath and environmental protection.

Following those considerations, here are a couple of examples, and many more can be cited, of research work ready for application or use in the national economy. The Polish-developed method of using silicon raw materials as substitutes for quartz powder can save 300 million zlotys annually in imports.

The production of precision piping according to Polish technology that is used as mechanized casing in coal mines will save $14 million annually in imports. The system for exploiting thick deposits in copper mining to be implemented in the 1982-1984 period will generate economic results worth up to 150 million zlotys.

The application on an industrial scale of the technology for obtaining pure benzene from coking benzol can provide Poland 300,000 tons annually of this valuable and desired product. And here is yet one more significant offer of science. Benzene production can be increased by 64,000 tons annually, which is worth about 500 million zlotys, if the research and development work is applied to intensifying the refining of raw material (catalytic cracking) by way of improving processes and equipment design. The production of 10 new potato variants can increase yields of edible potatoes from 0.3 to 0.6 tons per hectare, and industrial potatoes from 0.4 to 1.5 tons per hectare.

[Question] It is often said that many projects were completed, that they really represented a valuable and unquestioned accomplishment of Polish science, but to date there truly has never been a green light for innovation. We have much technology and many designs that would greatly reduce the scope of the crisis and would present an export opportunity if they were properly applied. The problem of our participation in the international division of labor and scientific-technical cooperation with the fraternal socialist countries is linked to this. That which we ourselves cannot do appears to be realistic within the framework of CEMA collaboration.

[Answer] Eight government programs and 56 complex problems have been verified. There are many research, development and application projects that assure goal achievement in the next few years. Scientific-technical cooperation with the socialist countries, above all the Soviet Union, not only can accelerate the achievement of results but can also increase them significantly.

We attach great significance to undertaking joint scientific and application projects within the CEMA framework. Thanks to material, subassemblies and

research equipment from the fraternal countries, some innovative solutions will be implemented quickly, to be repaid with scientific-technical ideas and products of high quality and modernity.

[Question] One of the barriers on the road to using the fruits of science was the persistent poor quality of research work results, their detachment from the realities of Polish industry. Raw material, material and energy possibilities were neglected. Unfinished work, lacking characteristics of technological design, occurred. How can these shortcomings and defects of institutions and research teams be avoided?

[Answer] We intend to expand significantly the scope and function of supervision at all levels of research work realization. We proposed to the sociopolitical Committee of the Council of Ministers that the principle of self-supervision and self-evaluation appertain anly to the scientific-technical value of executed work. This process should be the responsibility of the coordination-advisory organs for the individual research programs.

On the other hand, a more extensive analysis, economic as well as technical, especially with regard to the effectiveness of applications, must apply to the entire cycle of work, that is, from the programming phase to the accounting of end results phase. Thus, it is necessary for units coordinating research programs and ministries to designate responsible analyses and supervision groups. More extensive use of application agreements will also influence discipline of realization processes.

11899
CSO: 2602/27

NUCLEAR ENERGY PLANS TO YEAR 2000 OUTLINED

Zagreb KEMIJA U INDUSTRIJI in Serbo-Croatian No 9, Sep 82 p 469

[Text] Yugoslavia's expanded nuclear program up to the year 2000 has been adopted in all competent federal bodies, specialized and other commissions, electric power organizations and other organizations. The program proposed still has to go through the process of conclusion of social compacts and self-management accords among the various investors and users of nuclear power plants.

The nuclear program up to the year 2000 calls for construction of six nuclear power plants each with a capacity of 1,000 MW. The Prevlaka NE [nuclear power plant] will be built with the pooled capital of SR [Socialist Republic] Croatia and SR Slovenia; SR Slovenia will finance a nuclear power plant at Dolski near Ljubljana; SR Croatia and SAP [Socialist Autonomous Province] Vojvodina are planning joint construction of an NE on the bank of the Danube near Dalje. Two power plants, each with a capacity of 1,000 MW, will be built with joint investments of Croatia, Serbia and Vojvodina. A decision has been made for Croatia to join Serbia in building the Danube 2 Nuclear Power Plant near Smederevo.

World competition will probably be very keen when partners are chosen for Prevlaka and the other projects, and it will be interesting to see what the first interested partner "Framatome" is offering.

"Framatome," a French manufacturer of equipment for nuclear power plants and indeed of entire nuclear power installations, is interested in participating in construction of the nuclear power plant at Prevlaka through a system of mutual long-term cooperation and 100-percent transfer of nuclear technology. "Framatome" is not interested solely in the job at Prevlaka, but in becoming involved in Yugoslavia's entire long-range nuclear power program.

According to analyses made in "Framatome," Yugoslav industry would become involved in mastering sophisticated technology in the production of nuclear power equipment, and contacts have already been made with the factories "Rade Koncar," "Djuro Djakovic," "Metalna," "Litostroj" and the Steam Boiler Factory in Zagreb.

The problem of nuclear fuel would be solved through maximum use of raw materials from domestic sources, while the French partner would provide for

enrichment of uranium in its own installations on a long-term basis. The French are also offering to solve the problem of nuclear waste, which would be processed in their own factories, and the engineering would be developed for its subsequent geological stabilization. Beyond that the specialists of "Framatome" are offering all the solutions which have already been applied in France in connection with environmental protection.

The period of time over which "Framatome" commits itself to building average nuclear technology is 60 months.

7045
CSO: 2802/1

INNOVATIVE WORK IN SLOVENIA ENCOURAGES INNOVATION IN INDUSTRY

Zagreb KEMIJA U INDUSTRIJI in Serbo-Croatian No 9, Sep 82 p 469

[Text] Particular attention is being paid to innovative activity in Slovenia, since it affords more productive work, better quality and larger income. Adoption of incentives to encourage inventions is being undertaken in an organized way in work organizations of associated labor.

Last year in Slovenia there were about 3,500 innovators, and they produced and applied in practice about 4,000 solutions, and they made it possible to earn an additional amount of about 800 million dinars of income.

Innovative activity was most evident in the metal manufacturing, metallurgical and chemical industries, which employ one out of every five innovators. About 2,500 working people inclined toward creativity are organized in 25 societies of inventors and efficiency experts.

The number of workers who are improving technology at their work station is considerably higher than that. They are improving their work in order to exceed the quotas more easily and quickly, but they do not report their solutions. One of the reasons is the fear that the quotas might be raised, and the income which they earn from surpassing the quota is certainly greater than the lump-sum reward which they would get for their innovation.

Compensation paid to innovators amounts to about 3 percent of the estimated economic benefit which their innovations afford, and sometimes the compensation is even less because of a lack of understanding and envy.

Since the greatest contribution to stabilization is made by inventive workers whose solutions bring additional income to the entire collective and thereby to the broader community as well, the trade unions are advocating that collectives hire professional analysts of innovations and that the Social Compact on Innovations be supplemented. The trade unions go on to favor the extension of credit to finance development of inventive solutions.

7045
CSO: 2802/1

BRIEFS

KRSKO NUCLEAR POWER PLANT BASIN--Zagreb, Sep 82, KEMIJA U INDUSTRIJI--In a very strong international competition on a "turnkey" basis four work organizations which are part of the "Djuro Djakovic" Complex Organization of Associated Labor have been given contracts to design and manufacture equipment and steel structural elements, to erect and to start up (including tests and development of functional tests) the basin associated with the Krsko NE where the spent nuclear fuel is to be dumped. The work covered by the contract is to be completed by the spring of 1983, i.e., the basin is to be turned over to the customer for use on the eve of the first dumping of spent nuclear fuel. The capacity of the basin is to make it possible to preserve the stored nuclear fuel for 17 years. [Text] [Zagreb KEMIJA U INDUSTRIJI in Serbo-Croatian No 9, Sep 82 p 469]

LOLA 30 CNC CONTROL SYSTEM--Zagreb, Sep 82, KEMIJA U INDUSTRIJI--The Ivo Lola Ribar Industry has manufactured the first control system made entirely in Yugoslavia, the LOLA 30 CNC, and the importation of these machines will be altogether eliminated. The multiprocessor numeric control system was designed on the basis of the most up-to-date microprocessor technology. The software embodying all control functions has contributed to attainment of maximum reliability, and the modular conception makes it possible to make up systems for a variety of machines. The screen furnishes an abundance of information at any moment: the momentary position of spindles, the unit in operation and the four units to follow. Special display routines make it possible to examine and correct tables, to monitor operation of the programmable linkup with the machine and to display the state of all elements in real time. [Text] [Zagreb KEMIJA U INDUSTRIJI in Serbo-Croatian No 9, Sep 82 p 469]

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END

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22 December 1982

East Europe Report

SCIENTIFIC AFFAIRS

No. 763

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EAST EUROPE REPORT
SCIENTIFIC AFFAIRS

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NEW SOVIET COMPUTERS DISPLAYED IN BUDAPEST

Budapest FIGYELO in Hungarian 18 Nov 82 pp 10-11

[Interview with Anatoliy Smirnov, USSR deputy minister of instrument building, by staff reporter Farago: "New Computers in the Soviet Union"]

> [Text] Within the framework of the socialist countries' coordinated minicomputer program, the series production of two new models has been organized in the Soviet Union. The international introduction of the SM 1300 and SM 1800 models took place recently in Budapest. At a specialized show sponsored jointly by the Elektronorgtekhnika Foreign Trade Association and the Computer Applications Enterprise (Szamitastechnika Alkalmazasi Vallalat), Hungarian computer users were not only able to become acquainted with the computers, but they could also attend lectures on the software library, methods of application and the technology. Anatoliy Smirnov, USSR deputy minister of instrument building, came to Hungary to attend the show. We interviewed him on some questions of the production and applications of Soviet computers.

[Question] For what types of application are the displayed computers recommended?

[Answer] The developers of the SM 1800 system recommend it for industrial and scientific applications, and for data processing as well. Its design is modular, and thus very many different configurations are possible for the solution of specific tasks. The SM 1800 system is compatible with computers built under the socialist countries' unified computer program, and with several other types as well. Hence it can serve as the remote terminal of a larger computer system. Thus it is possible to set up concentrated data processing systems for multiplant enterprises and farms, within which information flows between plants located at various distances and their headquarters. The essential thing is that the information is transmitted over telephone lines, instead of being sent on paper or magnetic tape. Thus the system is not only more simple, but also more reliable. The SM 1300 may be regarded as the "little brother" of the already familiar SM 4. Its software is the same as that of the latter, it is able to perform the same functions, but its dimensions are substantially smaller. Thus it can be used also for applications for which the SM 4 is unsuitable, because of its larger space requirement. For example, the SM 1300 can be built into new equipment such as machine tools, process control systems, etc.

[Question] When will the export of these new computers begin?

[Answer] In the Soviet Union, one of the conditions for exporting industrial equipment and instruments is that they must meet the domestic specifications for their testing. The tests are already in progress, and the results are satisfactory. The R & D and industrial enterprises under the Ministry of Instrument Building estimate that exports of the SM 1800 system can begin already in the first quarter of 1983. Shipments of SM 1300 can begin not later than by the end of the year. These target dates are significantly shorter than what we set in the original program. The explanation of the shorter target dates is that very many sectors in the Soviet Union are demanding more modern minicomputers, and fortunately this demand of the economy and of the enterprises was combined with the new type of economic incentive for the developers and producers. The essence of this new type of incentive is that the bonuses of the persons concerned are the larger, the more the target dates are shortened.

[Question] How will the new computers be priced?

[Answer] Export pricing is the task of the foreign-trade enterprise. But I can say this much: even though the computers are able to do more, have modern microprocessors and are smaller than the SM 4, their production cost is lower. We believe the price, in comparison with the SM 4, can be reduced to at least one-half.

[Question] What is the explanation of the price reduction?

[Answer] During the past decade the Soviet Union gained considerable experience in the development and production of computers. This experience is now paying dividends. For example, planners and designers required less R & D time than in the past, the prototypes were built faster, and also the organization of series production required less time than what had been planned. Another cost-reducing factor is that Soviet supplier industries have been able to produce at lower cost the microprocessors, subassemblies and components for the new computers. We have been able to modernize significantly the production technology and the organization of production, as a result of which productivity has improved considerably.

[Question] Will the new computers be more reliable?

[Answer] Definitely. A basic requirement in the development of both types was that failures must be reduced to a minimum. We also introduced stricter quality control. We are inspecting all subassemblies and components, at the supplier enterprises as well as at the computer plants. Furthermore, we are devoting more time to testing the finished product, in order to uncover possible bugs. The ministry has not only formulated new guidelines for quality control, but it is also monitoring continuously the development of quality. In accordance with the reports, we resort to operational interventions when necessary. Which means that we reduce bonuses commensurately with the rise in the percentage of rejects. We are planning to perfect the economic incentive by taking into consideration also the final users' experience and comments. At the same time we are expanding our service network. There are now about 850 Soviet computers in operation in 18 countries. We are planning to increase our export by 10 to 15 percent a year. However, we are aware that to be competitive we not only have to ship on schedule, but must also ensure the servicing of the products we sell.

[Question] As you have indicated, the two computer systems just introduced are a part of a large-scale program. Where is the development of computers in the Soviet Union heading?

[Answer] In accordance with the international trends, we too are pursuing two directions. On the one hand we are working on perfecting universal computers. Which means primarily that we wish to expand the applications of a given computer. We are urging the development of computers that will make easier the management of large enterprises and the organization of production. On the other hand it is also our objective to develop small special-purpose computers whose areas of application will be limited, but which will offer substantial benefits to the economy and the enterprises in their areas of application. So far as computer power is concerned, here again we are thinking in terms of two categories: mainframes and small computers. There is less demand for intermediate computers, which is a worldwide trend, and for the time being it does not seem worthwhile to develop this type of computers.

[Question] There is much talk in professional circles about the still inadequate utilization of computers. What is being done in the Soviet Union to improve their utilization?

[Answer] A sample survey was conducted recently to determine the degree of utilization of the computers made by enterprises of the Ministry of Instrument Building. The results show that there still are many installations that are being utilized only 3 or 4 hours a day. Of course, this does not include process control computers. Therefore we are recommending that the leasing of computer time be introduced in the Soviet Union as soon as possible. But the administrative regulations and economic incentives for this must be worked out. The sample survey also serves as a guide for computer R & D and manufacturers, telling them in which direction they must proceed when developing new computers. Parallel with this we must urgently improve information for computer users. Often our user partners are still unable to formulate accurately their requirements and expectations.

1014
CSO: 2502/8

EYE PROTECTION AGAINST HELIUM-NEON LASER EMISSIONS ANALYZED

Prague JEMNA MECHANIKA A OPTIKA in Czech No 8, Aug 82 pp 201-205

[Article by Milos Horky, Institute of Instrument Engineering, Czechoslovak Academy of Sciences, Brno: "Use of Interference Filters for Eye Protection Against Light From He-Ne [Helium-Neon] Lasers"]

[Text] This study indicates the possibility of using protective interference filters in eyeglasses for protection against light from continuous-wave He-Ne lasers. They have the advantages of high transmissivity outside the suppression range, even when two filters are used one behind the other. In addition, they meet the condition of suppressing spontaneous radiation from the discharge tube below a dazzling level.

Introduction

The purpose of this study was to test the suitability of using interference filters for eye protection during work with continuous-wave He-Ne lasers developed by the Institute of Instrument Engineering in Brno and produced by Metra Blansko. Since their radiation flux (power) ranges from 0.8 to 100 mW, the main danger is damage to the organs of sight, and accordingly the use of protective glasses is essential.

The general principles are fairly well known and because of the specialized nature of the study we will not review them here. Nor will we discuss the selection of suitable domestically available frames, since it was dealt with in earlier discussions. We may recommend the BV 24 protective glasses (produced by OKULA Nyrsko and supplied by REMPO Kromeriz), in which the first pair of lenses can be removed. By mounting either both pairs or only a single pair of filters (as described below) we obtain suitable glasses for protection against laser light, which can be used even by those who wear corrective eyeglasses.

1. The Current Situation

The usual design makes use of absorption filters (colored glass, plastics) whose optical density in the wavelength region in question results in a permissible level of direct irradiation of the eyes. Despite its many advantages (simplicity, mechanical durability, low price and the like), this method generally gives a relatively low transmissivity in the visible region outside the suppression band. As a result, such glasses are often taken off because of poor visibility in the laboratory and because of the need to follow the track of the beam (for example, when adjusting it), so that the eyes have no protection at all.

2. Proposed Solution

A higher transmissivity outside the suppression band can be achieved by using interference mirrors adjusted in the same way as laser cavity mirrors. However, there remain considerable secondary interference maxima, which frequently limit transmissivity in the middle of the visible region where the human eye is at its most sensitive. Leveling out the fluctuations in the interference curve and increasing the transmissivity gives the interference filter a relatively steep boundary (high-frequency transmission, low-frequency attentuation), with a suppression band practically the same as with the mirror described. Fig. 1 shows plots of measurements on such filters for normal and 30° incidence (in the vicinity of the transmission, minimum additional measurements were taken with higher sensitivity; the interval marked "0.1%" shows the scale graduation).

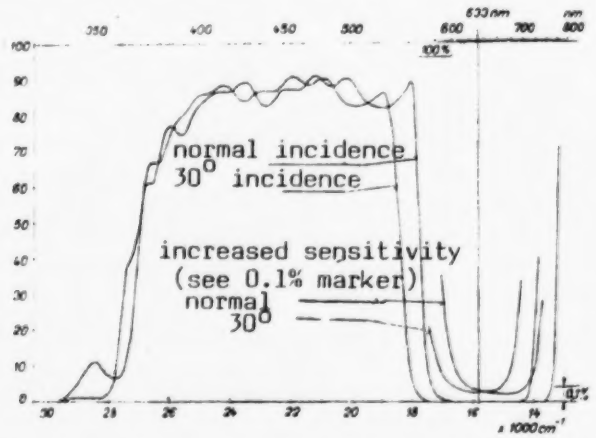

Fig. 1. Eyeglass filter for protection against light of continuous-wave He-Ne laser (50 mm diameter)

The smaller degree of suppression (τ = 0.05 percent) at the exposure wavelength of 633 nm may be a relative disadvantage of this type of filter. But by using two filters in sequence, for example, we achieve satisfactory levels, while the transmissivity outside the suppression band remains very good (satisfactory): (for our filter, from Table 1, $\tau = 0.85^2 = 0.72$).

Table 1. Transmissivity of filters for protection against continuous-wave He-Ne laser (λ = 633 nm), for lasers developed by CSAV-UPT Brno. Calculated for $E_d = 3 \times 10^{-7}$ W . cm^2, critical values are for $E_{kr} = 2.5 \times 10^{-3}$ W . cm^2, t = 0.25 sec.

Type of laser Typ laseru	Parametry laseru Characteristics of laser					Direct irradiation Přímé ozáření			Indirect irradiation Nepřímé ozáření		Dazzling by tube Oslnění trubicí	
	L_{res}	Φ	d_{xy}	S_{xy}	E	τ_p	$\sqrt{\tau_p}$	τ_{pkr}	τ_{m25}	l_{min}	l_{kr}	$\bar{\tau}$
	mm	mW	mm	mm^2	W.cm^{-2}	%	%	%	%	cm	cm	%
LA 1001	2000	80	3.0	7,07	1,13	2,65.10^{-6}	5,15.10^{-3}	0,22	0.74	291	3,2	7.4
LA 1002	1400	40	2.20	3.80	1.05	2.85.10^{-5}	5.34.10^{-3}	0,24	1.47	206	2,3	
LA 1003	450	6	1.15	1.04	0,577	5.19.10^{-5}	7,20.10^{-3}	0,43	9.82	80	0,8	
LA 1000	138	0.8	0.86	0.58	0.138	2,18.10^{-4}	1,48.10^{-1}	1,82	73.6	29	0,3	

Note: The quantity $\sqrt{\tau_p}$ gives the transmissivity of a single filter used to determine τ_p for two filters in sequence.

In the laboratory, when the laser tubes cannot be provided with a cover during experimental work, protection against spontaneous-discharge radiation is also a concern. What is required is to decrease the brightness of the tube surface to prevent dazzling. In the case of a He-Ne laser it is desirable to suppress the region above 560-570 nm (up to 650 nm), where the extremely intense line spectrum passes over into a band spectrum (in spectrometric terms; in other words, the discharge has an orange-red color). The emission spectrum in the visible region below 560 nm fortunately has a very low intensity, and the ultraviolet region below 340 nm, with its negative biological effects, is also limited, particularly by the glass base of the lenses. The protective filter also meets the requirements related to prevention of dazzling by the tube; the intense and undesirable parts of the discharge spectrum are virtually all included in the suppression bands, and there is no significant disruption of good visibility in the laboratory (a quantitative verification is provided in the calculations below).

3. Analysis of the Problem and Recommended Measures

In procedural terms we will discuss eye protection under the following headings:

3.1. Directly incident radiation:

3.1.1 Decreasing the intensity to permissible (harmless) level;

3.1.2 Critical momentary (t = 0.25 sec) exposure value for eyes

Note: Radiation reflected by a mirror may be considered equivalent to directly incident radiation, because from a safety standpoint a reflectivity close to 100 percent cannot be ruled out.

3.2. Indirect radiation in observation of the track of a diffusely reflected beam (assuming maximum diffuse reflectivity and uniform, i.e., Lambert, scattering):

3.2.1 Decreasing irradiation intensity to a permissible level:

(a) observation from usual viewing distance (l = 25 cm);

(b) minimal observation distance without attenuation by filters;

3.2.2 Critical momentary (t = 0.25 sec) eye exposure without filter attenuation

3.3. Prevention of dazzling during direct observation of laser discharge tube:

Even though adequate laboratory lighting can be assured during work with lasers, nonetheless for safety we must assume that the beam diameter is always smaller than the diameter of the pupil; in addition, the divergence

of the beam is negligible. Thus natural eye protection is of no importance, and we always plan on full (nominal) laser power.

3.1. Directly Incident Radiation

3.1.1. Decreasing the Irradiation Intensity to a Permissible Level

The transmissivity τ_p of the filter is governed by the requirement to decrease the intensity E of irradiation by the laser beam to a permissible level E_d:

$$\tau_p = E_d/E. \tag{1}$$

Since generally the radiant flux (power) Φ (W) of the beam and the beam diameter d (cm) are known, we can calculate the irradiation intensity E:

$$E = 4\Phi/\pi d^2 \ (W \cdot cm^{-2}) \tag{2}$$

and we can correct equation (1) accordingly:

$$\tau_p = 0.75\ \pi \cdot 10^7 \cdot d^2/\Phi, \tag{1a}$$

where we have taken $E_d = 3 \cdot 10^{-7}$ W . cm^{-2} in accordance with current recommendations.

3.1.2. Critical Momentary Eye Exposure for Directly Incident Radiation, t = 0.25 sec

This situation is considered only in foreign regulations, and accordingly for our conditions the irradiation intensity value E_{kr} given below is intended only for information purposes as the maximum possible value in emergencies. Equations (1) and (1a) apply for the filter transmissivity τ_{kr}, while we use instead of E_d the value $E_{kr} = 2.5 \cdot 10^{-3}$ W . cm^2 (for t = 0.25 sec):

$$\tau_{pkr} = 6.25 \cdot 10^{-4} \cdot d^2/\Phi. \tag{1b}$$

Note: The calculated transmissivity may perhaps be taken to be the overall maximum transmitted by protective eyeglasses, even though a higher value might be permitted, for example, in observing the track of a beam on a scattering surface (as discussed below). Protection against an accidental (unanticipated) direct incidence would then not be fully lacking, assuming that the blink reflex would not take longer than 0.25 sec.

3.2. Indirect Radiation, Observation of Track of Diffusely Reflected Beam

3.2.1. Decreasing Irradiation Intensity to a Permissible Level

The diffuse reflectivity of surfaces (on which the laser beam is incident) is assumed to be maximal in terms of power, and uniform, i.e., Lambert, scattering is assumed. Generally all surfaces which scatter light

sufficiently so that there are no visible specular glints are considered to be Lambert radiators. Thus not only do we follow current usage, but the computation which gives sufficient precision is a simple one (the errors will be far below the safety level used in establishing the permissible radiation intensity $E_d = 3 \cdot 10^{-7}$ W . cm^2: for example, the value $E'_d = 10^{-6}$ W . cm^{-2} given in reference 3 [references not reproduced] indirectly confirms this view).

The brightness distribution of a Lambert surface is usually represented by a sphere tangent to the surface, and thus we can represent the high-irradiation intensity E_n by the ratio of the radiation flux Φ of the laser beam and the surface of the sphere $S_k = 4\pi(\ell/2)^2$, where ℓ is the distance from the eye to the scattering surface:

$$E_n = \Phi/S_k = \Phi/\pi\ell^2 \ (W \cdot cm^{-2}) \tag{3}$$

The equation for the transmissivity of the protective filter with perpendicular observation of the track of the laser beam (this is the lowest value: at other angles the transmissivity increases with the cosine of the observation angle) will be similar to equation (1):

$$\tau_n = E_d/E_n \tag{4}$$

When the level of E_n from equation (3) is reached,

$$\tau_n = 3\pi \cdot 10^{-7} \cdot \ell^2/\Phi \tag{4a}$$

and a correction for the conventional observation distance $\ell = 25$ cm gives

$$\tau_{n25} = 1.875\ \pi \cdot 10^{-4}/\Phi \tag{4b}$$

The minimum distance ℓ_{min} for observing the track of the beam without a protective filter (for $E_d = 3 \cdot 10^{-7}$ W . cm^{-2}) is given by equation (4a) for a filter with transmissivity $\tau_n = 1$:

$$\ell_{min} = 1.826 \cdot 10^3 \cdot \sqrt{\Phi}/\sqrt{\pi} \ (cm) \tag{5}$$

In the laboratory this protection ("distance protection") is considered important only in the case of low-power radiation; at high powers the distances are rather large.

3.2.2. Critical Momentary Eye Exposure Without Protective Filter

We obtain the critical minimum distance ℓ_{kr} from equation (4a) by substituting $\tau_n = 1$, $E_d = E_{kr} = 2.5 \cdot 10^{-3}$ W . cm^{-2}:

$$\ell_{kr} = 20\ \sqrt{\Phi}/\sqrt{\pi} \quad (cm). \tag{6}$$

As in the case of direct eye exposure, we must recall that this situation cannot be allowed, and the figure is given only for information purposes. Fortunately, for lasers with power levels below 100 mW the critical distances

are very small (ℓ_{kr} = 3 cm); thus, with good worker discipline there need be no danger. We assume exposure until blinking (0.25 sec).

The transmissivity of protective filters (for 633 nm) calculated from all of the points of view described above for the series of He-Ne lasers produced by CSAV-UPT [Institute of Instrument Engineering, Czechoslovak Academy of Sciences] are given with their characteristics in Table 1.

3.3. Prevention of Dazzling During Direct Observation of Discharge Tubes of He-Ne Lasers

It is well known that dazzling occurs when observing a discharge tube. It may be described as vision-limiting, which at its mildest causes considerable difficulty in seeing or overall fatigue for a long period. It can be eliminated only by decreasing the brightness with eyeglasses, if a protective covering on the tube cannot be used. In our discussion we will take account of the relative transmissivity of the protective filter in the range where it attenuates the beginning of the intense (undesirable) part of the discharge spectrum (560-570 nm) and the beginning of its suppression band (about 600 nm). We do not consider the remainder of the discharge spectrum above 600 nm, because this falls entirely into the range of minimum filter transmissivity ($\tau \leq 1\%$), as follows from its nature.

In our computations we use the Netusilov formula for the dazzle factor G as specified by Czechoslovak State Standard 36 0008. Its target value is 25 or greater (for work in workshops or offices, for the field of vision with the usual direction of sight):

$$G = K \cdot B \cdot \omega^{0.4}/L^{0.5}, \qquad (7)$$

where K is a factor giving the position of the dazzling object in the field of vision and is equal to 1 if the source is on the visual axis; $B = E_t/\omega$ is the average brightness of the dazzling object for perpendicular incidence on the eye (in nits), E_t is the average irradiation of the dazzled eye by the source (the tube), in nits; $\omega = S/\ell^2$ is the solid angle of vision in which the eye sees the dazzling object (in steradians); S is the visible projection of the object as seen from the eye (cm^2); ℓ is the direct distance from the eye to the source (cm); $L = E\rho/\pi$ is the background brightness in nits; ρ is the diffuse reflectivity factor (for cream-colored plaster, ρ = 0.70); and E is the average background irradiation (in lux).

It follows from the foregoing that to calculate G from equation (7) it is sufficient to know the illumination from the tube E_t and the background brightness L. The measurements are made with a luxmeter.

Example of Calculation of the Dazzle Factor

We normalize the distance of observation to the tube to the conventional distance of 25 cm.

The diameter of the tube (or discharge) is d = 3.6 mm (for the LA 1001 laser with a power of 80 mW).

The length of the tube (or discharge) is determined for the maximum power for the optimum visual angle of the eye $\alpha = 2 \times 60°$ (we do not allow for a decrease produced by eyeglasses because this is not universal):

$$a = 2\ \ell_0 \tan \alpha = 2.25 \tan 60° = 86.60 \text{ cm}.$$

The solid angle ω of vision is:

$$\omega = a \cdot d/\ell_0^2 = 86.6 \cdot 0.36/25^2 = 4.99 \cdot 10^{-2} = 0.05 \text{ steradians}.$$

We calculate the laboratory background brightness L from the measured average illumination value E and the average diffuse reflectiveness ρ of the back wall, which is our case were E = 80 lux and $\rho = 0.5$, estimated for a cream-colored wall where part of the surface consists of the opal glass of the housing:

$$L = E\rho/\pi = 80 \cdot 0.5/\pi = 12.73 \text{ nt}.$$

We determine the brightness of the tube (or discharge) B from the illumination of the dazzled eye by the source (at the location of the eye), E = 200 lux (measured) for ℓ = 25 cm:

$$B = E_t/\omega = 200/0.05 = 4000 \text{ nt}.$$

Thus the dazzle factor G will be

$$G = K \cdot B\omega^{0.4}/L^{0.5} = 1 \cdot 4 \cdot 10^3 \cdot 0.05^{0.4}/12.73^{0.5} = 339.$$

Decreasing the calculated value to the guideline value $G_s = 25$ requires attenuation of the brightness by a filter with an average transmissivity

$$\overline{\tau} = G_s/G = 25/339 = 7.37\%.$$

This requirement is met by a single protective filter as described in Fig. 1, because the average transmission in the range 560-600 nm is considerably lower. As noted above, the calculation was made for the laser tube with the highest power, so that the conclusion is valid for the entire series presented in Table 1.

4. Suggestion for Design of Protective Eyeglasses, Especially for Research Laboratories

In a laser research laboratory it is frequently necessary to give priority to the observation of a diffusely reflected laser beam. A resulting requirement is good visibility of the track during any kind of adjustment or experiment, a condition which cannot always be met with a protective filter whose transmissivity for the exposure wavelength (633 nm) is chosen so that the density of two such filters in a row will meet the permissible

irradiation intensity conditions for direct incidence. This requirement is suitably met down to about 1/20 of the transmissivity value given by the calculation for observation of a scattered beam from the conventional observation distance. For a lower transmissivity, however, observing the beam will be difficult (this was determined in subjective tests with personnel who were involved). Under our conditions, the need is met by the transmissivity of filters which when doubled provide sufficient attenuation of direct incidence only in the case of the LA 1001 laser (80 mW), and possibly for the LA 1002 (40 mW). In the other cases, to preserve complete protection, i.e., unchanged transmissivity of the double filter, when increasing the transmissivity of one pair of filters for observation of the scattered track it is necessary to decrease the transmissivity of the other pair by a suitable amount. On design and production grounds, this condition is very difficult to meet with two pairs of filters, because the number of surfaces in a single system would increase disproportionately. But the requirements can be met with three filters (i.e., pairs), with the pair for high density produced by coating both sides of one lens. In the eyeglasses (e.g., B-V 24 and the like) they would be located in the removable part, and their removal would result in protection only against indirect irradiation, i.e., observation of a scattered track.

Given the power range shown in Table 1, we need to have at least two types of protective eyeglasses (or filters), as follows:

a. For the 80-mW LA 1001 laser and possibly the 40-mW LA 1002 laser.

The use of two pairs of identical filters with a transmissivity of 0.05 percent gives both protection against direct irradiation of the eye $(0.05\%)^2 = 2.5 \cdot 10^{-5}\%$) and adequate visibility of the scattered track of a laser beam in the case of one pair of filters.

b. For the 6-mW LA 1003 laser and possibly the 0.8-1 mW LA 1000 laser.

If we require that the transmissivity of one pair of filters give good visibility of the track of a beam with a power of at least 6 mW, we can provide direct-incidence protection with three pairs of filters. The first and second pairs, applied to a single lens, are mounted in the removable section of the glasses, while the fixed part has a filter with the proper transmissivity for observing the track (the third pair). The conditions are met by the following set:

$$\tau_1 = 0.05\%; \quad \tau_2 = 3\%; \quad \tau_n = 3\%,$$

whose total transmissivity of

$$\tau_p = \tau_1 \cdot \tau_2 \cdot \tau_n = 4.5 \cdot 10^{-5}\%$$

gives a suitable density for direct incidence up to 7 mW. A minor difficulty is the low transmissivity outside the suppression band (the average transmissivity in the blue and green part of the spectrum is $\overline{\tau} = 85\%$ for one filter and $\overline{\tau}^3 = 60\%$ for three). However, this set yields a considerably higher optical density in the exposure part of the spectrum.

The condition of full-day use of protective eyeglasses can be well met with a certain limitation (light-tightness of side flaps) by the frames of OKULA's model B-N 23 or B-N 25 protective glasses (the variant with an insert for corrective diopter glass), in which we installed the suitable protective filters instead of the original glass. Since these glasses are equipped with a removable part (as in the B-V 24), we can produce not only a suitable basic system as proposed for the B-V 24 glasses, but also a number of special-purpose combinations. Certain suitable arrangements are shown in Table 2.

Table 2. Some eyeglass sets for protection against light of continuous-wave He-Ne laser (633 nm) using B-N 23 (25), B-V 24 or B-A 24, B-N 30 (32) frames

1 Propustnost použitých filtrů (633 nm)				2 Ochrana pro			
3 pevná	sklopná část brýlí 4		cel-kem 5	mezní výkon laseru 6	ozáření 7		8 Pozn.
					přímé 9	nepřímé 10	
τ_n	τ_2	τ_1	τ_p				
%	%	%	%	mW	for τ_p	for τ_n	
0,05	0,05	—	$2,5.10^{-5}$	80	yes	yes	Základní (univerzální) provedení 11
3 %	3 %	0,05	$4,5.10^{-5}$	7	yes	yes	
3 %	bez sklopného dílu 12		(3 %)	7	nechrání 13		B-A 24, příp. B-N 30 (32) 14

Subscripts 1 and 2 denote the filter surfaces on the removable lens in the order in which the incident beam reaches them.

Subscripts p and n are used as in the text and Table 1.

Key:

1. Transmissivity of filter (633 nm)
2. Protection against
3. Fixed
4. Removable part
5. Total
6. Maximum power of laser
7. Type of irradiation
8. Note
9. Direct
10. Indirect
11. Basic (universal) design
12. No removable part
13. No protection
14. B-A 24 or B-N 30 (32)

As the table shows, in the case of protection only for observation of a diffusely reflected laser beam the removable section can be removed or a type without it used. In this case the light-protective eyeglass frames, especially of type B-A 24 or possibly B-N 30 or B-N 32 (with an insert for diopter glass) are usable, since they are fully suited to "permanent" use.

If corrective diopter glass is used, the coating (the filter) is applied directly to them (ideally to the inner side). Naturally, however, we must note the consequences of limited light-tightness of the frames around the eye and particularly the partial nature of the eye protection; this fact is known to specialists as regards the initial condition. In practice, however, it will be necessary to use at least double lenses in most cases, depending on the type of protection required and the power of the lasers being operated.

Because of the incompleteness of protection, however, the last-mentioned design is generally debatable, and its use is not recommended for the laboratories of ordinary users, because it does not meet the main conditions of eye protection against a directly incident beam.

Discussion and Conclusions

In this study, we have tried to analyze from every important angle the protection of vision against the effects of continuous-wave He-Ne lasers, examining not only questions related to the laser beam itself (633 nm) but also the effect of spontaneous radiation from the discharge tube (which is important for laboratory practice when for any reason an instrument cover cannot be used).

According to recommendations, the protective glasses are provided with dielectric protective interference filters, which may be the only type to meet the main condition of good visibility in laboratory work, i.e., good transmissivity in the visible range outside the suppression band, including the advantage of a steep boundary. Thus the condition that the workers not take their glasses off for any type of work, thus exposing themselves to danger, is met.

As already noted, the selected B-V 24 (or B-N 23 or B-N 25) frames allow very good attenuation with two pairs of filters, the first of which is removable. This makes it possible to observe a scattered laser beam with reliable sight protection (i.e., transmissivity combined with the required attenuation; when two filters, one behind the other, are used, i.e., the basic arrangement, the transmissivity for directly incident light is so low that the beam track generally cannot be seen at low powers). In other work with lasers, however, to assure complete protection it is necessary to use both pairs of filters, with the exception of the single-frequency LA 1000 laser, as can be seen from Table 1.

A comparison of the calculated transmissivity values for the exposure wavelength (633 nm) with Table 1 (measurements of spectral transmissivity of the protective filter) shows that the combination of two filters essentially achieves the values required for a direct beam from the LA 1001 laser with a power of up to 80 mW ($\sqrt{\tau_p} \cong \tau_{633}$). For oblique incidence of the laser beam, the design of the B-V 24 frames allows a maximum incidence angle of 30°, and the filter may have a higher overall transmissivity, because its spectral dependency is shifted. In particular, the protection against direct incidence of the laser beam may have some limitations in such a

filter (in the extreme case, meeting the maximum permissible irradiation intensity $E_d = 10^{-6}$ W . cm^{-2} recommended in reference 3). The solution of this problem is not, however, a basic difficulty: the requirement of complete attenuation can be met even with oblique incidence by an adjustment giving the same transmissivity for direct and indirect incidence, or by simultaneously adding to the sedi design of the system.

We must emphasize that we could have arrived at this new concept in eyeglasses for protection against continuous-wave He-Ne laser light only with the cooperation of personnel of the thin films laboratory of Meopta Prerov, led by RNDr Z. Knittl, CSc. The author takes this occasion to express his wholehearted thanks.

Glasses of this design manufactured as part of the state research assignment of designing an interference coating for laser engineering have been successfully tested in practice.

Note: An objection to the use of protective interference filters in protective eyeglasses is the idea that in group work it is impossible to prevent reflection of the laser beam from the filter of one worker into the eyes of another, because the protective filters have high reflectivity in the suppression band (the high density is for reflectivity, not absorption). This is, however, unimportant, because during work all personnel would be required to wear protective eyeglasses, which are suitable for direct irradiation and thus for a beam after specular reflection. While the absorption filters have a reflectivity which is an order of magnitude lower (two surfaces) than air, even in this case the reflected beam is little attenuated by specular reflection.

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METALLURGICAL ENGINEERING PLANT TO USE WELDING ROBOT

Prague HOSPODARSKE NOVINY in Czech 15 Oct 82 p 7

[Article by Eng Josef Pajer, CKD (Ceskomoravska Kolben Danek) in Kutna Hora]

[Text] The CKD manufacturing establishment in Kutna Hora is one of the relatively new establishments of the metallurgical engineering type. In addition to its main production line, namely production of steel castings, it also produces a large volume of various weldments. We have completed successfully several rationalization drives by putting into operation single-purpose welding machines of our own design and manufacture. We have already exhausted facilities of mechanizing straight line and circular welds by using hard automation. The next step can be made by mechanized welding in making welds running in any desired spatial direction. It is possible to follow this trend precisely by using an industrial robot.

Having acquired the first specific items of information about the use of robots for welding, we have evaluated the feasability of using a robot on an industrial scale. At present, we are already providing for an executory project and for individual components of the entire workplace.

The important initial step is to decide on the type of the entire workplace, whether we shall purchase it from foreign countries, mostly nonsocialist countries, or whether we shall build it gradually from domestic resources. In our case, we made a decision in favor of the second alternative, which does not involve any demand for foreign exchange.

In assessing the value of the weldments, we took into consideration the dimension of a weldment, its weight, the welding technology used, accessibility of the welding place, precision of the stitching or assembly of a weldment, and the produced quantity of weldments. After we had worked out an exploratory questionnaire, we submitted several standardized weldments for evaluation by the VUKOV [Metallurgical Research Institute] in Presov. VUKOV made the selection for the initial application. A weldment of the lower swing arm for the SAVIEM car was selected as the most suitable type. It can be characterized as follows:

--the weldment is composed of castings of KOHAL sheet metal 3.5-5 millimeters thick;

--the weight of the weldment is 14.5 kilograms;

--the contour dimensions of the weldment are 630 x 350 x 105 millimeters;
--welds made in a protective atmosphere of CO_2 are easily accessible;
--the quantity manufactured in monthly volumes is 2,000 pieces;
--the labor consumption of a welding operation is 0.334 Nh [newtons per hour];
--the accuracy of assembling a weldment is $\pm$ 0.9 millimeters.

In order to determine the last point, that is, the repeatability of the accuracy of the weldment composition, we made exact measurements of 30 stitched weldments on a new DEA coordinate-measuring machine. On the basis of 4,500 measurements, we have evaluated the mean deviation at $\pm$ 0.9 millimeters. In view of this relatively unfavorable result, we are forced to take steps during operations preceding the actual welding, in order to achieve a higher repeatable accuracy. We are providing for new pressing tools and rebuilding the stitching preparation. After the VUKOV Presov had selected for us the most suitable weldment for the robotized welding process, it processed the Basic Technical-Economic Assignment containing all the necessary data for an evaluation of the feasibility of the system, including an economic evaluation of it. This evaluation also includes a harmonogram of the construction of the entire workplace, and we are trying to maintain this harmonogram in reference to deliveries of individual components. The proposed time limit for delivery is 1984. We continue to cooperate with the VUKOV in Presov, which is now processing the executory project for us and arranging for the delivery of the PR-32 E robot with a control system.

The proposed design of the workplace calls for a whole series of peripheral installations. Provisions for these peripheral installations are among the most demanding preparatory stages of the construction work.

It should be noted that no domestic supplier delivers the workplace as a whole. In our case, for example, we have not solved as yet the problem of delivering the DOM 200 two-table rotary manipulator. Its manufacturer, the ZTS [Heavy Machinery Enterprise] in Detva, expects to give priority in its production to the requirements of its own VHJ [economic production unit] ZTS. We are getting the semiautomatic machine with a programming unit from Kovoplast in Nitra and the RMS 63 manipulator from the Bratislava Automobile Works. We are using our own resources to get the remaining equipment for the workplace, such as suction and clamping devices and safety equipment to prevent accidents. It is for this reason that construction and production facilities have to be made available. Provisions for individual components are directly related to the question of their reactivation and to operational guarantees in the composition of the entire workplace.

Technological use of an industrial robot for arc welding represents one of the most demanding applications. Welding cannot be compared, for example, to manipulation. I believe that precisely those workers who do the welding and who are aware of how demanding this technology is in terms of manual operations can see great opportunities in the use of robots. They were also among the first workers who cooperated closely with the CSVTS [Czechoslovak Scientific and Technological Society] and considered the possibility of using industrial robots. However, the situation is quite unsatisfactory at present with regard to welding in terms of procurement of basic aids and equipment. This situation puts in a

paradoxical position our efforts to use the most modern technology. Welders themselves reproach us, for example, for preparing the use of robots, when at the same time they do not have electrode holders which they unconditionally need for their work. Nevertheless, we are trying to inform the broadest strata of the working people in the form of lectures and excursions precisely about the opportunities and all advantages of robotization, because support and initiative by the working people is very helpful in the implementation of the program, and we have to count on it. In the meantime, a point which continues to remain unsolved in our case is professional handling of the operations at our workplace in reference to "control system--industrial robot--next peripheral system." It will be necessary to get and train a specialist for the used system which belongs to a new generation, a specialist in electronics who will take care of the system's maintenance and eventual repairs. The personnel at the workplace will receive specialized training and will be selected from among a number of experience welders, because the job involves a demanding technological application and requires professional supervision and thorough operations control. We want to use this first workplace for testing all matters related to the application of an industrial robot. We have now selected additional weldments for which it would be possible and economically advantageous to use an industrial robot. At the same time, we have now worked out a study of the possible use of industrial robots for polishing operations (finishing of castings).

I assume that every builder will encounter the following problems:

One general contractor alone will not deliver the entire workplace. This involves procurement of individual components and reviving and maintaining smooth operation of the workplace.

One must expect to use qualified construction and production facilities for the manufacture of fixtures and atypical positioning devices.

The basic problem of introducing robotization in welding is how to provide for repeated accuracy of assembly and positioning of the weld surfaces.

One must expect a different labor organization at the workplace: continuous feeding and removal of weldments, technical aspects of programming and maintenance of the workplace.

There is no other way except using the initiative of the working people. One must also count on active support by the management of the enterprise, party and trade union organs, and take advantage of the initiative of CSVTS members.

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PROBLEMS, GOALS OF TECHNICAL DEVELOPMENT NOTED

Budapest MUSZAKI ELET in Hungarian 28 Oct 82 p 5

Excerpts from speech by Gyula Szeker, chairman of the National Technical Development Committee: "Technical Development and the Technical University"]

> [Excerpts] This year the Budapest Technical University is celebrating the 200th anniversary of the founding of its predecessor, the Institutum Geometrico-Hydrotechnicum. A celebration was held for this occasion on 13 October in the assembly hall of the university with the participation of Istvan Sarlos, member of the Political Committee of the Hungarian Socialist Workers' Party and deputy chairman of the Council of Ministers, and Bela Kopeczi, minister of culture.
>
> The series of celebrations being held on the occasion of the 200th anniversary of the Budapest Technical University continued the next day with a scientific session. Karoly Polinszky, rector of the university, opened the session. Speeches were then given by Andras Korcsog, Gyula Szeker, Lenard Pal and Pal Tetenyi.
>
> We here publish excerpts from the talk by Byula Szeker. In our next issue we will give a compilation from the other three speeches.

The place and the occasion alike prompt me to speak of the current and future problems of technical development. The 200 year old Budapest Technical University and its predecessors have been for a long time among the most qualified depositaries and greatest institutions of Hungarian technical progress. They have enriched our technical knowledge with inestimable values and the theories, inventions and innovations born within these walls have formed our thinking.

It seems strange to emphasize the importance of technical development at the Technical University. Today the entire world is striving to re-examine

and reformulate according to the requirements of the age the methods, guidance and institutional system of technical development. It would be an erroneous simplification if we were to feel that a good economic policy could itself produce correct technical development. It would be similarly erroneous to take the position that a good general policy starting from the sphere of the economy would automatically give birth to correct guidance methods.

Strengthening the innovative readiness and capability of the economy and accelerating technical progress are key questions of our development because only in this way can we increase the ability of our economy to perform. Strengthening profit interest and the entrepreneurial spirit are essential conditions for the acceleration of technical development. But research and technical development cannot rely exclusively on the self-regulation of the market (and cannot be regarded exclusively as an enterprise task either); thus, the state must undertake a guiding and mobilizing role with an optimal combination of market self-regulation and state guidance.

Technical development is fundamentally an enterprise task; that is, the enterprise is responsible for the direct conduct of technical development. This responsibility cannot be given to another, so the enterprise must have those resources in the possession of which it will be capable of realizing technical development. At the same time, even the most liberal capitalist countries raise technical development to the state level in some way, as the most important tool for long term survival, for competitiveness, for preserving or winning a position.

Thus, in the new value order of the world economy developed technology has gone up in value. As the intellectual work content of production has increased, intellectual resources have gone up in value also and products with a high content of intellectual work have become the focus of development.

Central developmental programs have an important role in the realization of the strategic goals of technical development. These very important developments requiring large investments cannot be selected and cannot be financed only on the basis of short term market requirements nor do they affect only one or two enterprises. Carrying out these programs requires the coordinated work of several guiding organs and a number of enterprises, often belonging to different branches. Let us think, for example, of the many-sided aspects and effects of the computer technology, electronics, petrochemical and pharmaceutical and crop protection materials programs.

There is a close link between the innovation readiness of society and the preparation of the technical intelligentsia. Unfortunately the social prestige of the technical intelligentsia has decreased. In general the engineers do not complain about the lack of material recognition but rather about the insignificance of engineering work, about the limits on personal development and advancement and about the fact that in a significant part of their working time they do not carry out engineering tasks.

The income situation, way of life, general and professional culture and morale of the technical intelligentsia have a crucial influence on technical development. Thus it is an important task for us to put an end to the decrease in the social prestige of the technical intelligentsia.

I feel that it would be proper for us to review briefly what sort of technical development tasks we must solve by the end of the century to ensure our economic growth.

First place in development must be given to those areas which will help modernize the economic structure outside their own sphere as well. Our homeland is not capable of competing along the entire front of technical development and activity. We must select points of emphasis. It is very important that we recognize in time the more significant areas for this emphasis.

The areas to be examined and treated in a stressed way from the viewpoint of the development of our economy might be:

--electronics, systems of tools and solutions for information transmission and processing;

--biological technologies of outstanding importance connected with agriculture, from the viewpoint of techniques now known and possible in the future; and

--those branches of industry which have critical technological areas for quality.

Let me give a few examples in regard to our more important problems and the chief goals of technical development. The idea has spread recently that as a whole the mineral and raw material situation of Hungary is more favorable than we had thought. This is true, but on the basis of an international comparison our situation can be classified only as weak.

We must develop our long-range plans so that our energy use up to the end of the century can increase by only one-quarter as compared to today. We must reckon with a similar situation in raw and primary materials supply up to the year 2000. For us, energy savings achieved through technical development are a profitable energetics investment. If we raise the efficiency of our energy use only to the level already achieved by developed industrial countries we can achieve a saving of 20-30 percent.

The oil price explosion has cast a new light on energetics. Extreme views began to circulate concerning the energy supply of the world after the two price explosions. In the meantime, however, it became clear that, while we need not fear the early exhaustion of the energy resources available in the world, the age of cheap and secure energy supply is over.

Rational use of fuels is fundamental in our economic policy. We should constantly adjust the structure of our energy use, reducing the ratio of

liquid fuels and increasing the coal, natural gas and nuclear energy sources. The most effective way to use the domestic coal is in the production of electric power which, together with nuclear energy, will take the place of oil products.

The biggest problem of our ferrous metallurgy is that there is a high proportion of SiO_2 in the iron ore processed, an average of 20 percent. Thus, in a blast furnace, we get 850 kilograms of slag for 1,000 kilograms of pig iron, and this is more than double the amount of slag in west European blast furnaces. Thus we use 30-40 percent more coke for our pig iron manufacture.

We must increase the ratio of our quality steel production from the present 10 percent to 25-30 percent with steel works developments to be completed. Expansion of the production of so-called secondary products cannot be postponed; these are metallurgical products requiring a higher degree of processing (cold rolled sheet and strip, cold drawn rod and wire, cold formed profiles, welded pipe, and tinned, zincked and plastic coated products). By the year 2000 we want to double production of these products through our developmental program.

The technical development and further expansion of our aluminum industry, based on our bauxite deposits, will serve our raw material supply as well as the interests of our economy as a whole. The Hungarian-Soviet aluminum industry agreement has proved mutually very effective and we must strive to continue this cooperation in the future also.

The situation in machine manufacture technology has changed radically in the past one-two decades in that electronics has made possible the "NC technology" solutions. Operations performed by various items of equipment can be ordered into a single centrally controlled process, generally controlled by computers.

Electronicalization--the broad penetration of electronic devices into every branch of the economy and the most varied spheres of society--is a world phenomenon. The foreign competitiveness of our products depends more and more on the electronics used in them. We must create a base for our electronic parts industry, the basis for which is provided by the "Electronic Parts and Subassemblies Central Development Program" approved by the Council of Ministers in 1981. But we must also create a receptive culture, preparing the users, which requires a new attitude from economic and technical experts and leaders alike.

Metal cutting remains the chief technology for machine manufacture, although the share of plastic forming may increase.

The manufacture of highway vehicles has the highest volume in the production structure of our machine industry. Its foreign market positions are significant in the socialist and other developing countries and the headway it is making in a few developed capitalist countries merits attention also. The chief goals of technical development here are material

and energy conservation, reducing harmful emissions, greater passenger comfort and accident safety and less need for maintenance.

The primary material base for domestic petrochemical production is the Leninvaros olefin works established within the framework of the Petro chemical Central Development Program.

Cooperation with the Soviet Union is expanding further. In accordance with a protocol signed in the first half of 1980 the Soviet Union will build, by 1986, an ethylene works similar to the Leninvaros works. By the end of the century it will deliver to our homeland, from its production, 60 kilotons of ethylene per year, through the existing pipeline. Up to 1986 ethylene will be exported but following that the ethylene remaining here and the imported ethylene will make it possible to double our annual production of synthetic materials.

Our conditions are favorable for improving the competitiveness of the Hungarian pharmaceutical industry and crop protection materials manufacture. We are working out a central development program for the purpose of further development, for the manufacture of pharmaceuticals, crop protection materials and intermediaries.

We must preserve the grain and rough fodders produced in crop production, primarily by chemical means. We must make them available to animal husbandry supplemented with feed supplements, vitamins and yield increasing materials. Specific fodder use can be decreased with fodder management modernized by the achievements of chemistry.

Standardized construction should expand in the further development of the construction industry so that production can be increased 1.5 to two times with existing tools.

So what do we expect from our old university in the decades ahead? There is so much to be done, but we have many engineers desirous of deeds. It would be difficult to choose which tasks to stress, on the solution of which tasks to concentrate our technical resources, difficult to say what the university can offer to this. One can only outline a few ideas here.

The need for technical progress, accelerated in the present world economic situation, requires something different from the educational system than what we are used to traditionally. It requires a new structure of information and mastering it at a higher level to be sure, but it expects that in addition to mastering the general basic information necessary for an understanding and further development of current technology it will make the maturing generation capable of an adequate forming of social-economic relationships. It must have as its goal the development of human behavioral forms, aptitudes and abilities which will make it possible for the young person to be capable throughout his life of throwing out obsolete information and mastering new.

A better unfolding of technical creativity is one of the conditions for getting rid of our inadequacies; and this requires much knowledge, creative abilities and a willingness to assume responsibility. We need engineers who know languages and have experience in economic questions, who are capable of recognizing the technical novelties appearing in the world and of using them, depending on their economic utility. Thus, in the future, we will need not more engineers but rather more talented engineers, with greater knowledge. In the training of engineers quality, not quantity, must be put in the foreground.

The present trends of our economic development provide little scope for great technical creations, for costly investments. But the significance of clever, good management is increasing, and the technical-economic intelligentsia can find their own role in this also.

In training our engineers it would be good to strive to see that the students got a broader view and more experience than belongs to their narrower speciality. On the one hand a sufficient degree and level of inter-disciplinary view will facilitate the cooperation of different sorts of experts, and on the other hand it would encourage accommodation to quickly changing technical development.

8984
CSO: 2502/5

COMPUTER PROBLEMS, PRODUCTION, OPERATING TIME DESCRIBED

Computer Production, Operating Time

Warsaw ZYCIE GOSPODARCZE in Polish No 43, 14 Nov 82 p 12

/Article by Janusz Ostaszewski/

/Excerpt/ We supposedly produce one-third of the number of electronic subassemblies per capita which Western Europe produces and this is not such a bad production level. One may have doubts whether, in fact, this is really not so bad, but on the other hand, when one considers how this part of electronic production, which all over the world serves to boost businesses and is called information science, is exploited in our country--one could well ask the question whether we do not actually overproduce since it is wasted, anyway.

The regression in the production of computer hardware and in its applications supposedly began somewhere around 1976. There exist today, it is true, some 3000 various computer information centers and this is almost double of the number in 1975; however, only a few service what they should. A major portion was organized in accordance with the voluntarism which was taking over the economy and the state without any consideration for costs, needs, or the preparation for computer use of those who were going to work with it. So it is hard to know (as already mentioned) whether one should be saddened or should should rejoice that production has fallen off. From the number of 105 computers and 352 minicomputers in 1976 we have fallen, five years later, to 14 computers and 81 minis. In the ambitious plans and programs of dynamic development we were also supposed to have had at least 5000 computers installed in 1980, and, according to some even more dynamic prognoses, even 10,000. In the end, they counted a year ago only 2633, out of which only 874 were large and medium computers. In the civilized world, at the outset of our sad decade, there were 88 computers per 1 million inhabitants, while in our country, four times fewer. The only consolation is that they do not devour electricity and do not use up paper. For if there were more of them they would probably be working on command "by the whistle" or they would be covering up the inertia of those who would hide their indolence behind the computer just like their well-entrenched colleagues do.

Our Polish electronic brain does not get overworked. Just like the live one--it ploughs through the 9.6 hour day and then rests. If it is a "teenage"

one--a minicomputer--it works only 4.8 hours a day and then goes home. There are even such lazy machines that, ever since having been imported for dollars several years ago, are still in a virgin state and are awaiting even better times

.....

And since, in spite of everything, here and there, certain of the complex programs managed somehow to get carried out, so they have managed to educate the personnel. And now they do what they happened to get, or were lucky to get, at the employment placement office. It is not known, either, whether they have managed to slow down this production of computer personnel who will not be needed for anything. It is known only that by 1990 there were supposed to be almost 30,000 with higher education and 50,000 with intermediate education. So if they are still in their respective schools today and are sweating over textbooks they better quit dreaming and switch to something more useful. For electronics is, indeed, an instrument of progress in every domain of economic life all over the world but that does not necessarily apply to the economic life in our country.

Industrial Computer Problems

Warsaw INFORMATYKA in Polish No 4-5, Apr-May 82 pp 52-53

/Article by Czeslaw Rybak/

/Text/ I would like to present here main problems of information science in industrial enterprises on the basis of experiences of a large machine producing establishment, namely Communication Equipment Production Plant PZL-MIELEC. I have observed that these problems are typical of many industrial enterprises where the digital computer constitutes an essential link in the system of information. I will deal with one of the main fields of application of information science in an enterprise, namely with automation of processing of data for management purposes.

Computerized information is broken down into organizational units assigned to leading activities (construction and technological services, management of the enterprise). Computer center with data processing equipment belongs to management service. This dependency determines the thematic range of data processing subsystems as to their operation, implementation, and design.

The computer center at the PZL-MIELEC is composed of three departments: digital computer operations, systems design and programming, and card punching machines (actually: mechanized input data preparation department). The center uses computer R-32. Available hardware is almost completely used up (the machine has been in use since 1977). This fact when linked with lack of spare parts (which are supposed to be supplied by ELWRO) markedly increases its unreliability. According to recorded data for 1981 average time of computer operation between succeeding failures was 1 hour 18 minutes. Not every malfunction brought down the entire computer or required repetition of calculations.

Poor technical condition of a digital computer forces adoption of such organizational solutions that assure processing on time and application of such technologies of processing that minimize losses caused by the necessity of repeating or re-starting of calculations. In order to assure processing on time the enterprise must undertake cooperation with nearest institutions which have computers of similar configuration. Well-designed processing technologies take into account computer configuration and hardware unreliability. For this reason magnetic tape units are limited to three and number of large (30 MB) direct-access disks to two. Programs with more than 1 hour of running time are required to include restart capability in case it becomes necessary to resume processing after a machine halt (unfortunately, large part of software purchased--mainly at ZETO centers--does not have such capabilities). In addition, limiting the number of tape units used by the system allows parallel processing (in two partitions of memory). The index of multiprogramming for 1981 was 1.8.

Vendors programs purchased outside or subcontracted to outside sources as well as many of the in-house written programs caused numerous difficulties during their implementation and during operation. It is particularly difficult to force or to carry out necessary organizational changes at the users of the system, particularly at those supplying the data, if they do not see obvious advantages from the application (necessary changes in current and historical documentation frequently require verification and supplementation of tens of thousands of data documents). In the case of implementation of relatively simple systems, when only one activity is cooperating with the computer center--one interested in automating some of its operations--introduction of changes necessary from the point of view of processing of data runs generally rather smoothly.

Experience acquired from implementation of many systems--both purchased and written in-house--allows to conclude that, to a greater or lesser degree, all the same errors always manifest themselves due to such causes as: inadequate correspondence of the processing model to the real world, incomplete data, data errors, small bugs in software. Due to this the most difficult phase of realization of the entire project is its implementation. It is in this stage, also, that a breakdown and abandonment of implementation most often occur. It is easier to overcome difficulties when implementing own software due to continuous contacts between user, system's designer, and programmers. Errors are corrected as they manifest themselves. Pursuit of the common goal resolves conflicts between people or between entire activities.

The qualification level of systems designers and programmers also becomes a problem. The systems designer, beside knowing problems of his own profession, must know well the area of operations of the enterprise for which he is designing the system, must know the organization and the conditions in which that enterprise is operating, and also must possess psychological disposition for communicating with the system's users. It is rather difficult to find persons fulfilling those requirements within the enterprise.

Often a person with many years of seniority in the enterpise who finished several courses in system design and programming becomes a systems designer.

If one compares this approach to the position of a systems designer with road that has to be travelled by a computer professional who does not know the specifics of the particular enterprise I come to the conclusion that computer professionals will master knowledge of a given business operation faster than a practical person will master computer science.

Personnel difficulties of computer centers of individual enterprises increased lately as a result of considerable fluctuation of staff personnel flowing mainly in the direction of ZETO /Main Center for Electronic Computer Equipment/. There one could earn much higher salary and additionally the work there is less tedious, "cleaner" than in the industry—it consists to a considerable degree of writing vendors software. The results of this outflow of personnel are still being felt in computer centers of individual enterprises, all the more so since it concerns mainly employees with highest qualifications.

Basic difficulties which system designers and application teams must overcome are caused by following organizational and human obstacles:

- source documentation not adapted to the requirements of the system

- incorrect index base (from the point of view of information science)

- considerable inertia of organizational structures

- passivity (and often simply resistence) of engineering and technical as well as administrative and clerical staffs

- relatively low level of organizational discipline

- slight (and often nonexistent) knowledge of computer science problems among engineering and technical staff.

The above-mentioned obstacles are not usually known to computer service centers. Even when contact between the industrial enterprise and the main computer center of the ZETO type is maintained it is most often done through representatives of that enterprise's computer services. There are cases when during a transition period it is necessary to maintain duplicate documentation: one that serves the existing information flow in the enterprise and another for the needs of the system being implemented. This demands additional work and discourages the user, especially when he is not particularly interested in the system being implemented. Data supplied by the user is then delayed, often incomplete, and full of errors. This, of course, is in turn reflected in the quality of produced reports. Since it is the computer services who supply those final reports they are blamed for poor quality of this information.

I am convinced that the main cause of the difficulties just presented is the lack of sufficient interest in the computer science shown by management of the enterprises who often protects and tolerates employees who refuse to submit to the discipline imposed by digital computer...

Most widespread breakdown of applications of computer science for management purposes is so-called deparmtental breakdown. It corresponds to the classical differentiation of basic activities of the enterprise such as:

- technical preparation of production
- materials management
- management of fixed assets
- employment and payroll
- production control
- finance and cost accounting
- sales of finished products
- management of tools.

The model of a computer system of the enterprise is constructed in accordance with this division. Within individual departments tasks, subtasks, and elementary functions are identified and they determine the division into systems, subsystems, and modules of the data processing system. In individual departments computer applications are at different stages of advanced development. This depends on the amount of interest that the management of those departments has in using data processing to automate simple but time-consuming clerical tasks.

Although department of technical preparation of production is that department from which systematic implementation of information system should begin (since it supplies original data from the point of view of control of other departments) it does not always get needed support from the management of the enterprise. The choice of tasks to be undertaken is often dictated by immediate needs of the enterprise. For example: the team of systems designers and programmers assigned to employment and payroll of PZL-MIELEC was for almost a year working on "flurry" of changes in the salary system which occurred around 1980/1981 turn of the year. Similar things occurred with assignment of ration cards for state-controlled goods. There has practically not been a single month where the base for assigning them has not changed.

The state of affairs thus presented has an impact on the organization of work of a computer center and also on data processing technologies and programming techniques employed.

The deep economic crisis which has engulfed our country has not spared the computer science field. It is felt most painfully in the area of supply of new computer hardware, spare parts and basic operating supplies: punch cards and paper for printers. ELWRO center does not accept for repairs equipment which--according to existing regulations--it should repair. Only 25 percent of orders for punch cards and printing paper have been accepted. Very poor supply of spare parts and operating materials greatly lowers the morale of computer personnel employed by computer centers.

Right now work still goes on using materials and spare parts in stock. One lives on hope that there will soon come a radical change.

I have the impression that not everyone realizes the consequences which coming to a complete halt in digital computers would entail. Just as it was in the case when the computer system was being introduced, the enterprise would have to be prepared to change back from the automated to the manual processing of data. In order, for instance, to replace the work of computers at PZL-MIELEC it would be necessary to employ some 900 people.

Due to the present situation work assignments have been redirected. Practically speaking, all development of new applications has been stopped in favor of improving the effectiveness of used hardware and improving the quality of software. This period of--I hope--temporary stagnation in the development of new computer applications for management purposes should be used for improving qualifications of computer specialists. For the greatest loss for the enterprise would be the loss of qualified personnel.

12207
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DEVELOPMENT OF FIBER-OPTICS COMMUNICATIONS OUTLINED

Warsaw PRZEGLAD TELEKOMUNIKACYJNY in Polish No 5, May 82 pp 107-111

[Article by Wladyslaw Cetner, Julian Kowar, and Andrzej Zielinski, Communications Institute, Warsaw: "Works Carried Out in the Communications Institute in the Field of Fiber-Optics Telecommunications"]

[Excerpt] The first work dealing with the use of coherent optic radiation for the needs of telecommunications was undertaken in the Communications Institute already in 1968. The work then concerned open (working in open space--atmosphere) optic lines using modulated laser light.

In the 1970's the CI [Communications Institute], together with the Military Technical Academy (IEK-WAT), participated in the program of research carried out jointly with the Central Institute for Scientific Research in Communications (CNIIS) in Moscow. This program included the building and testing of an open [optical] line operating on a wavelength of 10.6 micron meters, using CO_2 laser.

In the CI, intensive research in feber-optics technology was undertaking beginning in October 1979, when the Independent Fiber-Optics Telecommunications Laboratory was created.

Scope of Research in Fibe.-Optics Technology in the Communications Institute

The world development of fiber-optics technology and the development of multimode fiber-optics at the Marie Curie-Sklodowska University in Lublin caused a rather wide range of research and design work to be undertaken in the country in the field of fiber-optics telecommunications. This work was organized in the framework of key problem 06.2 titled: "The Development of Telecommunications--the Systems and Equipment," for which the Communications Institute was in 1975-1980, and still is, the first-stage coordinator. Unfortunately, the current symptoms of the economic crisis, and above all the curbing of the import of elements which are not produced in this country, have necessitated a considerable cut in the size of research and a critical selection of the most urgent and at the same time realizable [research] questions.

The main emphasis was put on proper future development of telecommunications fiber-optics in this country, based chiefly on solidly build foundations in

the fields of metrology, technology of fiber-optics and cables, optic-electronic elements, and fiber-optics elements and systems. The development of active elements--luminescent diodes, semiconductor lasers and photo-sensors transcends the established frames of the CI's research activity. The development of those elements was entrusted to the Electronics Institute of CEMI and the Division of Experimental Physics of the Marie Curie-Sklodowska University. The development of production methods and the experimental production of fiber-optics were undertaken in the Division of Physical Chemistry of the Marie Curie-Sklodowska University, while the experimental production of fiber optics cables is presently carried out as part of the work of the DOPiT [District Post and Telecommunications Directorate] in Lublin.

The Communications Institute has undertaken the development of passive elements, components of the fiber-optics systems. These are solid and separable (plug-in) junctions of the segments of fiber-optics, directional (hybrid) couplers, and change-over switches, as well as other elements. The junctions are an indispensable part of fiber-optics systems and of appropriate measuring systems and equipment.

Unlike that of the connecting junctions, the production of solid, welded, glued and separable fiber-optics junctions presents a serious technical problem. This is due to the limiting of optic power losses in the junctions. These losses grow strong when the inaccuracy of connections is of the order of a few micrometers in the joinings of multimode fiber-optics, and below one micrometer in the joinings of one-mode fiber-optics. Solid junctions must also be made outd-ors at the installation of the fiber-optics cable.

The directional interconnections (socket outlets) and fiber-optics switches are technologically difficult elements in the process of their production and therefore expensive to import. They are indispensable in fiber-optics subscriber networks, in cable television and in aerial systems of collective reception realized by fiber-optics technology, as well as in more complex measuring stations.

The Communications Institute's undertaking of these themes arose from the rise in import prices for fiber-optics elements and the demand for them by the Institute and the domestic market.

The Institute also includes in its research work in the fields of measuring the basic parameters of transmission cables and fiber-optics, such as: attenuation, dispersion, the profile of the refraction index, and geometrical parameters of fiber-optics cables. The latter concern the core diameter and fiber-optics lining, and the size of their deviation from the circularity, concentricity and misalignment. These parameters should be compatible with the recommendations of the CCITT.

In the sphere of this basic research, indispensable for fiber-optics telecommunications, the Communications Institute has already obtained concrete results, which will be more extensively described in the later part of the article.

Testing of Junctions

In the Communications Institute a small series of separable junctions has already been produced. On the previously described measuring station a measurement of attenuation of these junctions has been made.

The testing included about 200 solid junctions: the joinings were made of segments of the same fiber-optics, and segments of fiber-optics selected at random, in geometrical and optical parameters (refracting index, numerical aperture). The results show that junctions welded by the method elaborated at the CI, made of like segments of fiber-optics usually had losses below 0.1 dB, which corresponds to good junctions made by Western firms. In the case of junctions made of fiber-optics segments differing much in parameters, the losses were between 0.4 and 2.0 dB.

It ought to be emphasized that the CI has already received several orders for the described device (type FS01) from domestic and East German customers.

The welded junctions are characterized by the smallest losses and are commonly used in fiber-optics communications systems. The places of welding result from the length of the segments of the manufactured cables used for installation outdoors. The welding place must be appropriately secured from cracks and external damage, because [the welding] is done on the fiber-optics itself, without its protective layer.

Other Fiber-Optics Tests

The measurement of the profile of refracting index along the diameters of the lateral section of the fiber-optics is very important because of the minimalization of mode dispersion in multimode fiber-optics, which limits the width of the frequency band of the transmitted information, or causes harmful expansion (or rather a flattening) of transmitted pulses in digital systems. As already mentioned, the measurement of the profile allows to define the geometrical parameters of the fiber-optics.

The dispersion is measured in the fields of frequency and time. In the latter case, the enlarging of the pulses transmitted as the optical wave propagates along the fiber-optics, is measured. For understandable reasons, the narrowing of the transmitted frequency band and enlarging of the pulses limits the informational traffic capacity of both analogous and digital fiber-optics systems.

In the Communications Institute appropriate methods of measuring these two quantities were developed.

Fiber-Optics Systems

Mastering the methods of precise measurements of attenuation and dispersion values of fiber-optics, and--in the case of multimode gradient fiber-optics--the profiles of changes of the refracting index, production of a certain number of separable junctions and mastering the technology of welded junctions,

constituted the basis for realizing the main task of the Communications Institute, that is, developing the appropriate transmission instruments and installing and testing fiber-optics telecommunications systems.

In technologically advanced countries, many experimental and operating fiber-optics systems are already functioning. They can be found in all the elements of the telecommunications networks; in local and long distance telephone networks, and in subscriber networks with integrated audio-video data transmission services.

In Poland a wide implementation of fiber-optics systems is also foreseen. For this reason during the current 5-year plan the CI intends to install on its premises an experimental fiber-optics system that would allow for local testing of both its own subassemblies, instruments and systems, and ones supplied for this purpose. The length of the cable route need not be too great, because by joining in a series of the fiber-optics which are part of one or several cables virtually any size system can be obtained.

A very important problem is to develop in the shortest possible time domestic optic-electric elements with parameters and reliability that would allow their application in telecommunications fiber-optics systems.

From the moment of the creation of the telecommunications fiber-optics laboratory in the CI, work on miniaturized transmitting and receiving assemblies intended for use in fiber-optics telephonic digital systems and in systems to be used in the transmission of television signals has been going on.

Currently a transmitter and receiver that go toward the making of a universal digital system with the multiplication factor of 30 and 120 telephone channels are in the final stage of development. The measuring station for the testing of this system together with its instruments is shown on illustration 15 [not shown]. These instruments are basically intended for installation in an experimental fiber-optics system located on the CI's premises. The digital systems developed in the CI are also to be installed in Lodz, where an experimental system connecting two telephone exchanges is to be started. After the final termination of the experimental testing of the fiber-optics systems, the results obtained will be presented separately.

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END

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EAST EUROPE REPORT
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RESEARCH WORK IN FIELD OF NUCLEAR PHYSICS DESCRIBED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 3, 1982 pp 16-24

[Article by Prof Zhelyu Zhelev and Senior Scientific Associates Vasil Khristov and Nataliya Yaneva: "Nuclear Physics Research in the Field of Low Energy in the Bulgarian People's Republic"]

[Text] Currently research in low energy physics is conducted in the following Bulgarian centers: Institute for Nuclear Research and Nuclear Power Industry (IYAIYAE) of the BAN [Bulgarian Academy of Sciences], the Nuclear Physics Chair of Sofia University, and the Nuclear Physics Chair of Plovdiv University.

The basic systems for these studies are the following: the IRT-2000 research nuclear reactor, which has been in operation for the past 20 years; the ILU-4 ion implanter, and neutron generators. A number of instruments have been developed for nuclear physics and neutron-physics measurements, such as magnetic beta-spectrometers, a bicrystal neutron diffraction meter, semiconductor spectrometers for gamma rays and beta and alpha particles and splitting fragments, a Mossbauer spectrometer, a scintillation spectrometer for fast neutrons, a diffusion and streamer chamber in a magnetic field, the Romashka multi-section scintillation gamma ray detector, a gamma-gamma correlation spectrometer, and others. Detection electronic devices have been developed, including some within the KAMAK system. The automation of the gathering and processing of experimental data are taking place with the help of small I-1001 EIM-TRA computers, two IZOT 310 machines, two M6000 machines, one ES-1020 and various types of analyzers.

Our scientists are convinced that this experimental base is extremely insufficient. In recent years problems of its further development, updating and automation have been actively discussed. A reconstruction of the nuclear reactor, its increased capacity and updating of its experimental possibilities have been undertaken. The decision was made to undertake talks on the procurement of a U-250 heavy ion accelerator from the USSR. A base is being laid for the production of modules within the KAMAK system and microprocessor systems for the automation of the nuclear physics experimentation.

Highly skilled cadres are at work in the field of low energy nuclear physics in Bulgaria, trained mainly at the Joint Nuclear Research Institute in Dubna and in a number of top institutes in the USSR and other countries.

1. Experiments With the IRT-2000 Reactor

Research in the physics of splitting heavy nuclei is a traditional line which has been developed for many years both independently in Sofia as well as in cooperation with the Joint Nuclear Research Institute (OIYAI) in Dubna and the I. V. Kurchatov Atomic Energy Institute (IAE) in Moscow.

An experimental method was developed on the basis of the double impulse ionizing chamber with grids. The processing of the experimental data is accomplished with a small computer related to the chamber electronic system. Correlated mass and angular breakdowns of the fission fragments are obtained.

The correlation between the photographic breakdown sections into 232 Th, 235 U and 238 U from energy in the 6-9 Mev interval was studied on a specialized channel of the reactor, especially equipped for obtaining quasi-monoenergetic gamma rays through the use of threshold reactions, with an ionizing camera. The same correlation for 239 Pu was measured with glass for the first time in the world (Figure 1).

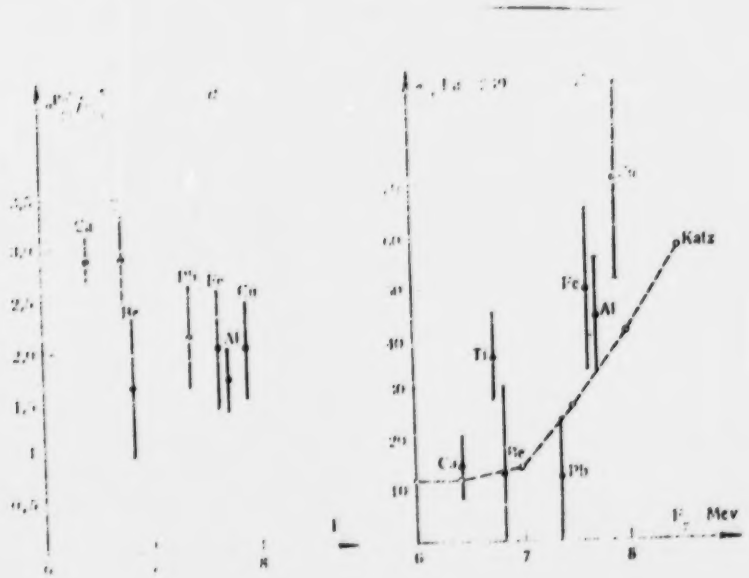

Fig. 1. a. Ratio among sections of photofission of 238 P and 235 U;
b. Correlation between the photofission section of 239 P and energy. The dotted line indicates the results of other authors obtained through the chopped radiation.

The ionizing method is also used in correlation measurements of mass and angular breakdowns of the fragments of the fission of 238 U of the neutron beam (energy 1.6 Mev) of the accelerator at the Fission Physics Laboratory of the I. V. Kurchatov IAE. Experimental data were obtained of 700,000 acts of fission, which are being processed.

Work on measuring and assessing neutron constants of the fissionable nuclei are the natural extension of such studies. This is necessary in the computation of fast neutron reactors, made within the framework of cooperation among CEMA-member countries. The Neutron Physics Laboratory of the OIYAI in Dubna, a joint group of scientists from the Physics-Energy Institute in Obninsk (USSR) and the IYAIYAE of the BAN is working on a program on measuring screened neutron sections of fissionable nuclei. On the basis of semiconductor silicium detectors with a large area, manufactured by the IYAIYAE and the small SM-3 computer equipment was created and experimentally tested for measuring the variations of total kinetic energy of the fission fragments of 235 U in the resonance area of neutron energy.

The IYAIYAE of the BAN, working jointly with the I. V. Kurchatov IAE (group headed by Dr Muriadyan) has developed equipment for absolute measurement of alpha values (the ratio between radiation detection and fission sections) for 235 U at the heat point of the neutron energy with the use of the Romashka multisectional scintillation gamma ray detector.

Also part of fission physics are the studies of independent production of iodine isotopes--132, 133 and 134--with the fission of 238U with above cadmium neutrons. A radiochemical method has been applied in extracting the iodine isotopes from the radiated uranium sample, after which gamma spectra are measured with a Germanium-lithium detector. The chains A = 134, A = 132 and A = 133 are considered. Independent extractions have been obtained of 132 I, 133 I, and 134 I in terms of the cumulative extraction of 135 I, which are consistent with theoretical predictions.

Experiments in the study of conversion pairs of argon and hydrogen are taking place with the IRT-2000 reactor. A diffusion Wilson camera with a magnetic field, used for recording electron-positron pairs of internal conversion into argon and hydrogen has been assembled at the heat column of the reactor at the nuclear problems laboratory of the OIYAI. Such reactions have not been studied so far due to the fact that the sections in argon and particularly in hydrogen are much smaller and that the creation of a track detector which can work within the intensive gamma ray of the reactor is quite difficult. A total of 120 cases of registration of selector pairs--positrons--were singled out among the 20,000 stereo frames which were obtained. Within the energy spectrum of the pairs we note a grouping of lines around 3 and 4 Mev.

A streamer camera was developed for the further efficient study of the tapping of heat neutrons with the formation of conversion pairs in argon and hydrogen. This became the base of a streamer spectrometer for electron-positron pairs. The camera is controlled and has a short memory time, for which reason it can operate with a wide background. The working gas in the camera (argon or hydrogen) plays the role of a target, which facilitates the observance of the points or origin of the conversion pairs and the angular and energy measurements.

Figure 2 shows the exterior of the streamer spectrometer with the camera and the pulse feed system. The streamer camera works successfully with an argon charge with quite clear and properly localized traces.

Preparations for experiments on the study of gamma radiation obtained with a nonelastic dispersion of fast neutrons from the reactor spectrum and related effects, particularly the Doppler shifting of gamma-quantum energy, radiated from moving nuclei, were undertaken on the horizontal channel of the reactor in 1977.

A nonstandard experimental system was used to measure the lifetime of excited nuclei conditions based on Doppler's shifting. This represented a first combination of the advantages of two modifications--the simultaneous measurement with two targets (specific for charged particles) and a single target (applied in the reaction of nonelastic dispersion of fast reactor neutrons). Results were obtained for the nuclei 27 Al, 32 S, 58 Ni, 60 Ni, 45 Sc, 55 Mn, 59 Co, 40 Ca, and others. Further development of such work is planned in the mass area of A $\sim$ 90 ÷ 130, in which there are reasons to expect original results.

Experiments with cold and ultracold neutrons are being conducted on the reactor. Neutron carriers for such experiments were designed and experimentally tested and a time flight spectrometer was developed. A mechanical method (neutron turbine) was developed for obtaining ultracold neutrons with velocities of under 10 meters per second.

Studies are being made of the interaction between cold neutrons and the substances. Experimental data have been obtained on full cross sections of interaction with Ag, Cu, In, Ni, Fe, Mo, Ar, N and dry air with neutrons with speeds within the 50-100 meters per second and 100-250 meters per second intervals (cold neutrons). A substantial deviation of the 1-V law was noted at speeds of under 120 meters per second.

The methods of neutron optics are extensively applied in studying the structure of crystals and determining the atomic order of amorphous substances. The DN-520 neutron diffractometer which was obtained from Poland in 1975 is being applied in diffraction studies of solids.

The neutronographic method was used in the study of crystal chemical and magnetic parameters of ferrites (Bulgarian production) with a view to clarifying some problems of the technology of synthesis. A study was made of the influence of oxide mixtures on electric and magnetic parameters of ferrites with a spinning structure: Ni-Zn ferrites with additions of ZrO_2, No_2O_5, Sb_2O_5; Mn-Zn ferrites with superstoichiometric content of Fe_2O; Mg-Mn ferrrites with small additions of Ho_2O_3, La_2O_3 and CeO. Data were obtained on the correlation between a number of macroscopic parameters with microscopic ones (changes of the grid constant, oxygen parameter, cation breakdown and value of the magnetic feature of the ion of the respective magnetic subgrid depending on the type and valence of the additive) under different circumstances of the synthesis of the models. The results of the orthoferrite $TmFe_1$-x MnO_3 and the isostructure system with pure orthoferrite of $TmFeO_3$ provide new data on the physics of phase transitions.

The structure of alloys of rare earth elements, used in the development of strong permanent magnets was determined.

A method was developed for the basis of the dispersal of neutrons for the study of amorphous substances, increasingly applied in optics, electronics and laser technology. Studies of systems synthesized on the basis of Tellurium dioxide with different modifiers indicated that the close atomic order in a determined concentration of the modifier is similar to the structure of α-TeO_2 rather than α-TeO_2 contrary to prevailing opinion.

II. Nuclear Spectroscopy and Mossbauer Spectroscopy

Research in this area was significantly hindered by the lack of an accelerator. Despite this, our spectroscopists, who were well trained abroad, were able to organize efficient cooperation with physicists in Dubna, the GDR, Czechoslovakia and Romania. On the basis of such cooperation we are obtaining some long life radioactive sources from Dubna and our physicists are experimenting with accelerators in other countries. A high percentage of the developments in the physical interpretation of experimental results takes place in Sofia.

A series of studies of magnetic β-spectrometer dealt with the nuclei of 147, 149 Sm, and 153 Eu, which are close to the border of the transition from spherical to strongly deformed (N = 89). We know that studies of the nuclear structure in this area have been in the center of attention. For example, measurements were made in the breakdown of 153 Gd of the spectra of electrons in internal conversion and gamma rays in the deformed nucleus of 153 Eu (N = 90).

It is of interest that in addition to ordinary multipolarity, data were obtained on the value of the electric quadripolar aspect of the excited condition of 103 Kev and parameters which express the effect of the penetration in internal conversion in the transitions 97 (E1), 103 (m1) and 173 Keb (M1). It turned out that the penetration parameter λ_1, related to the electric charges in the nucleus and the parameter λ_2, related to the spinning transition currents have low values (Figure 3).

Substantial information was acquired on the gamma-transitions of weakly deformed nuclei in the lanthanum-barium area. The data prove the complex nature of the status of the nuclei. Only a few of them prove to consist of a single particle. There are grounds to believe that the characteristics of these transitional nuclei could be understood within the framework of a model with a particle attached to an anharmonic central part.

A traditional direction followed in our work is the measuring, classification and interpretation of probabilities of electromagnetic transitions. We know that such probabilities are quite sensitive and are perhaps the most sensitive values related to the wave functions of nuclear conditions. For this reason they are the best tests for nuclear models. Measurements with nanosecond isomers take place in a state of radioactive breakdown in cooperation with the Nuclear Spectroscopy Department of the OIYAI Nuclear Problems Laboratory and in cooperation with the Central Institute for Nuclear Research in Rosendorff (GDR) and the University of New Jersey (United States) of a bundle of alpha particles and heavy ions.

Several years ago, other authors discoverd a number of IR (irastovi) isomers in 176 Hf. Together with a German group, our associates used a Ge (Zi) detector to measure the record-setting short lifetime of a high spin multiparticle status of 15^{+} $T_{0,5} = 0.20^{+13}_{0,07}$. Such an isomer was found in the 178Hf nucleus as well.

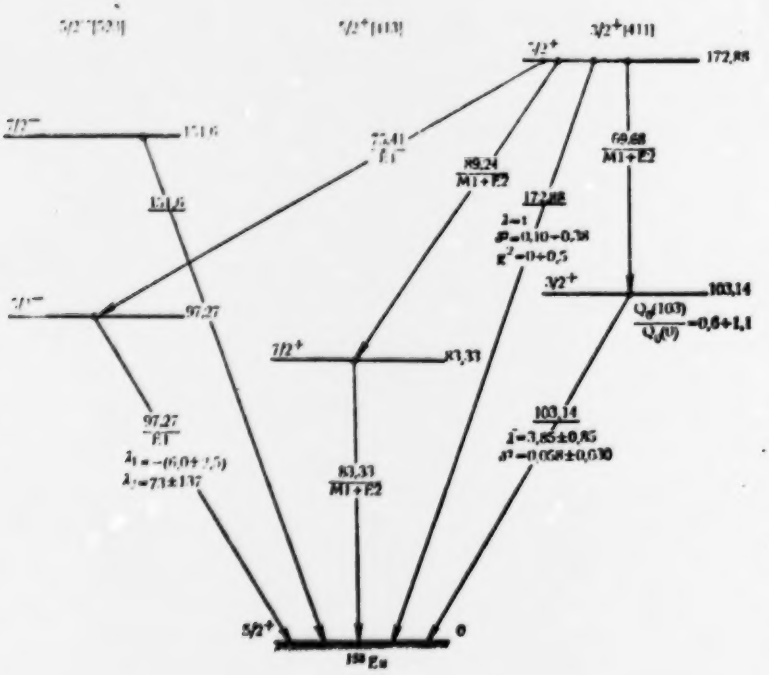

Figure 3. Results of Measurements of $\beta - \gamma$ -Spectra of 153 Eu.

Following are several examples of the work on systematizing probabilities of electromagnetic transitions. A weakening of spinning polarization of the core of the Arima-type is expected in the vicinity of the close strata and a decline in the probability of M1 transitions, which are forbidden on the basis of the quantum figure 1. For the first time systematics have been made of the 1-forbidden transitions for all mass areas. In the case of nuclei in the N = 20 area the probabilities M1 have been strongly manifested. Transitions in mirror nuclei (25 Al-25 Mg) have been similar in size. This may be explained by the isovectorial dominant in the magnetic dipole operator. It is interesting to note that work on 1-banned M1 transitions were carried out by Bulgarian, Soviet and American physicists.

Another example is that of collective transitions E2 in the basic stripes of the deformed nuclei. We know that the strength of the tie between the "back-bending phenomenon of the inertial aspect and the changes in the moment of E2 transition is strong is still being debated, and the problem remains unresolved in its microscopic variant. Our physicists suggest a consideration of the power function S E x B (E2), which has proved to be quite sensitive in terms of the spinning frequency. This may offer additional proof to the effect that the hydrodynamic model is valid in such nuclei to a spin equaling 8.

The IYAIYAE is engaged in studies based on the method of gamma-gamma-angular correlations. Measurements are being made of the electromagnetic aspects of excited nuclear levels, the multipolarity of gamma transitions and electric and magnetic fields influencing radiating nuclei. To this effect a fully automated correlation spectrometer (Figure 4) was developed.

Measurements of differential time-related angular correlations were undertaken in recent years. The breakdown capability of the spectrometer, obtained with a source of 22 Na, with windows for differential discriminators, consistent with the maximum values of 181 Hf with energies of 133 and 482 Kev and plastic NaJ (Tl)-detectors reaches 1.3-1.7 nanosecunds FWHM. This spectrometer was used to determine the disturbance factor $G_2(T)$ on the level of 482 Kev for 181 Hf in Hf_2Pb_3, Hf_2Pd_2 and HfB_2. The frequency of the quadripolar interaction was $\omega_1 = (517 \pm 10)$ MHz; $\omega_2 = (800 \pm 4)$ MHz.

With a view to the detailed study of the electron-positron interaction and its application to the study of the electron structure of matter experimental studies of the annihilation of positrons are conducted by determining the lifetime of the positrons, the doppler expansion of the annihilating gamma line and the angular correlation of annihilation gamma-quanta.

Measurements were made of the angular dependence of the diffusion widening of the Mossbauer line in a copper monocrystal. The Mossbauer source of a monocrystal copper plate with an admixture of 57 Co with T = 1,030°C was studied. The widths of the Mossbauer lines photographed from different angles between the wave sector of the recorded gamma quantum and axis (100) of the copper monocrystal are different. The diffusion expansion of the Mossbauer line depends on the recording angle. The vacancy diffusion mechanism with jumps in the first coordinate sphere is confirmed in a first approximation. This is the first experiment providing such data.

Dysprosium orthoferrite with a partial substitution of trivalent iron ions and ions of bivalent cobalt was studied with the help of the Mossbauer effect. At 42 degrees K the so-called Morin transfer took place in the dysprosium orthoferrite. When iron ions are partially replaced by other ions a variety of properties of dysprosium orthoferrites may be obtained. With bivalent cobalt as a 0.25 percent substitute the Morin transfer shifts toward higher temperatures of up to 100 degrees K and a new reorientation appears which is never found in pure dysprosium. The Mossbauer spectra of this material reveal that in the 250-155 degrees K range a smooth rotation of the iron spins takes place from the X to the Z axle on the XZ plane. At the end of this reorientation the spins are in a position of 20 degrees of the Z axis. Below 155.5 degrees K a new reorientation begins. The spins of Fe^{3+}, which do not reach reach the Z axis leap along the Y axis in a purely antiferromagnetic order. In this case we also note the Morin transition of a spatial type.

III. Applied Research

Extensive activities are taking place in our country on the application of the results of scientific research in low energy physics in the national economy. Let us cite a few examples of basic lines of applied research.

In cooperation with the USSR Academy of Sciences Institute of Nuclear Research studies are underway on the development and application of the pulse neutron method developed by V. M. Kazarnovskiy and K. Ilieva, using the results of the theory of the nonstationary diffusion in environments containing large cavities. Pulse experiments conducted with a neutron generator made it possible to determine with an accuracy of up to 1 percent the albedo of heat neutrons in water and ethyl alcohol delaying agents.

Under contract with the International Atomic Energy Agency in Vienna, a number of nondestructive methods for controlling nuclear materials were developed, including a neutron-coincidental method for determining the presence of plutonium in nuclear industry products for purposes of inspection control.

A method for determining the depth of exhaustion of nuclear fuel was developed for VVER-440 reactors. A gamma scanning method was developed and applied. The possibility of applying the X-ray fluorescent analysis in determining the accumulation of plutonium in exhausted fuel was indicated. A detector with a high differentiating capability is used. Precise correlations were established among the products of fission, combustion of the basic fuel and accumulation of plutonium. The studies were conducted with the help of minitablets which are placed in the dry canal of the cassettes with the basic fuel, radiated and analyzed. A method for determining the hermetic sealing of the cassettes is being developed as well.

A series of gamma radiation instruments for scientific research or industrial purposes has been developed. Gamma radiation using powerful sources is being applied in the development of genetically new strains, stimulation of seeds (National Agroindustrial Union), canning fruits, vegetables, meat products, ground meat and protein item canning, biological protection, and others.

The IYAIYAE is working of neuron-activation analysis. The IRT-2000 reactor is used for radiation. The study of short-life isotopes is conducted with a pneumatic tube developed in one of the vertical channels of the reactor. Methods have been developed for identifying more than 30 elements in geological and other projects. Work is underway to determine the microelement composition of organs and tissues of healthy and sick people and experimental animals for diagnostic and treatment purposes. Determining industrial pollution in water and its influence on living organisms inhabiting it is also being studied.

Studies of angular and energy breakdowns of single and multiple dispersed beta radiation of materials with different Z are being conducted by the nuclear physics chair of Plovdiv University. These studies led to the creation of a family of beta reflectors thickness-measuring devices and instruments for the study of bicomponent systems used in the laboratories of a number of plants.

Work related to the development of methods for measuring low activities and the mastery and development of methods for carbon dating are taking place within the programs for the application of radioisotope methods in industry. A new method has been created to compensate for the residual background in low-phonic detector systems. A model was developed to determine the geometric factor in low-phonic detector systems. Industrial equipment for measuring NFA-3 low beta-activity was applied.

Interesting applied studies are being made with the IRT-2000 reactor in Sofia in the field of radiation dosimetry, radiochemistry, radiation chemistry and production of isotopes.

More than 24 different types of isotopes with an overall activity in excess of 40,000 millicurie per year are obtained with the help of this reactor.

For a number of years the atomic physics chair of Sofia University has studied the Mossbauer effect and its applications. A new method was suggested for the study of fine surface layers known as depth selective Mossbauer spectroscopy, based on the combined utilization of the beta-spectrometer and the Mossbauer analyzer. The Mossbauer electron spectra with different energies yield information on the structure of the phonon spectrum of the "substrata" located at different depths--1,000 A in tin with 100-200 A step. Subsequently, the method was developed at the university in Stockholm and is currently being developed and applied in the USSR, the FRG, Japan, France and the United States. It is being extensively used in the study of chemical and physical phenomena in thin strata, corrosion, and others.

For the first time a resonance scintillating detector and a resonance ionizing camera have been developed and are finding scientific and practical application.

Other methods for analysis using the Mossbauer effect have been developed as well. Studies have been made of a number of chemical compounds and of the behavior of combinations of iron with tin, which accelerate the process of sulfur-free vulcanizing of some varieties of rubber.

9503
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DESCRIPTION OF GROUND STATION EQUIPMENT FOR SATELLITE MEASURING

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 3, 1982 pp 25-29

[Article by Prof Dimitur Mishev, Scientific Associate Engineer Garo Mardirosyan and Engineer Dzanka Indzheva: "Mobile Ground Station for Synchronous Satellite Measurements"]

[Text] The sum total of tasks, methods and technical facilities for telemetric study of the earth from outer space represents a complex multi-step system based on suborbital (mainly ground) systems and complexes for data gathering and processing. The results obtained from ground measurements not only supplement and make possible the effective processing of data provided by artificial earth satellites, manned space ships and orbital scientific research laboratories but are also exceptionally valuable data needed in resolving a number of entirely separate scientific -theoretical, scientific-applied and national economic problems in the areas of geophysics, geology, geography, meteorology, hydrology, the study of natural resources, environmental studies and protection, agriculture, and so on. Ground measurements become particularly important when they are synchronized or, rather quasisynchronized with experiments and studies conducted with the help of airplanes and in outer space. Considering the relatively large territories on which they take place and their specific nature, it is expedient to conduct ground measurements with the help of mobile laboratories and complexes.

Considering the nature of their work, such mobile laboratories must meet a number of specific requirements, the main ones of which are the following:

High mobile and increased cross country qualities, which make possible their movement along rugged and steep terrains, along roads and roadless areas;

Possibility of establishing and beginning normal operations within minimal amounts of time;

Availability of highly reliable, small-sized equipment with low power consumption, capable of withstanding mechanical loads;

Possibility of fast primary data processing on the spot;

Efficient and flexible structure--possibility of quick and easy reorganization of studies in various geonomic areas;

Compatibility and possibility of participation as an element of complex research systems.

The main prerequisites governing the creation of a mobile scientific research laboratory are the following:

Availability of motor vehicles, trailers and buses with increased cross country capacity and of suitable dimensions;

Availability of modern electronic equipment--small-sized, highly reliable, economical in terms of power supply and highly resistant to mechanical loading;

Availability of modern facilities for long-distance data transmission, recording and processing.

In connection with the implementation of the "Intercosmos" program and the "Bulgaria-1300" space project, the Central Laboratory for Space Research of the Bulgarian Academy of Sciences designed and developed a prototype of a mobile ground station for synchronous satellite measurements (PNSSSI). It is one of the possible variants of a developed general purpose mobile laboratory for synchronous and comprehensive space and geonomic studies.

As a compromise, the body of the Chavdar-5S bus with 4-wheel traction and 230 millimeter clearance was taken as a basis for the development of the PNSSSI. It is powered by a D-3900 four-stroke diesel engine developing a maximal power of 85 hp.

The structure has been reinforced and computed in such a way as to withstand a static load of about 400 kg. Flanges, brackets and other propping elements have been mounted on it, as a result of which antennas, apparatus, tripods and other systems may be installed at different heights and in different positions. The main equipment on the roof is a 4,000 millimeter long arm, which is a light duraluminum structure, The arm is carried on the roof in a horizontal position and has two main working positions, as follows:

a. Along the axle of the body, in which the arm may assume a variety of positions: from a transportation to a vertical position and to 30 degrees below the level of the roof, with an overall work sector of 210 degrees. The equipment which can be installed on it could range from 0 to 6,500 millimeters above the grounds;

b. Crosswise--used in mounting larger equipment at heights ranging from 0 to 4,500 millimeters above the ground.

If necessary, the equipment may be mounted on the arm or the roof with the help of special universal joints, which guarantees the strictly vertical or any other strictly defined location of the apparatus, regardless of the position of the arm or the bus itself. Using the flanges on the roof of the PNSSSI and with the help of the duraluminum pipes, a variety of other structures may be mounted

in all directions for mounting the equipment, protective covering, and others. the roof is accessible through a light mobile ladder which could be mounted to the body in five different locations.

The roof of the PNSSSI is painted in red and white squares, in chessboard fashion. In the case of joint studies involving aircraft and helicopter laboratories, it could be used as a standard in terms of form and dimension (scale) for determining the influence of the atmosphere, a bench mark, etc.

The hull of the PNSSSI meets increased heat and humidity insulation requirements. It consists of a working and storage premises. The working premise has built-in shelves and stands on which the equipment can be mounted. The most efficient use is that of apparatus with a module design. Depending on their resistance to mechanical vibrations, they can be installed directly or through special shock absorbing elements.

In addition to the driver, the PNSSSI can handle four more passengers sitting on three luxury SV-type seats and one mobile seat. Natural and artificial ventilation, and kerosene and electric heating and facilities for air conditioning have been made available in order to maintain the necessary microclimate.

In addition to the standard automotive electrical system, the PNSSSI has special power, measurement and radio installations.

Primary power may be provided with the help of two systems:

a. Battery: A special shelf contains two 6-volt and two 12-volt Ni-Gd batteries with a 50 Ah power. The battery terminals lead to a panel from which the following voltage can be obtained: +6, +12, +18, +24, +30, +36, ±6, ±12 and ±18 volts. The batteries can be recharged. Furthermore, they can also be recharged while the bus is in motion through the electric generator of the bus' engine;

b. Power grid: In operating in the vicinity of a power grid electric power of 220 volt/50 Hz is possible. This is achieved with a corresponding installation, a control-measuring panel and a 180 meter-long cable.

All electric panels have the necessary control-measuring equipment, meters and safeguards. The feeding and measuring cables are switched on to the PNSSSI through special coupling panels. The body of the PNSSSI can be grounded.

In general, the equipment which is part of the PNSSSI facilities may be classified into the following basic groups:

Secondary power supply--for the transformation and stabilizing of electric tension obtained from the primary power supply system.

Measuring equipment--recorders and transformers of the parameters of the studied targets:

Recorders of spectral reflection characteristics;

Recorders of the temperature of the ground air stratum, the surface stratum and temperature profiles;

Recorders of the humidity of the surface stratum of the soil and depth profiles;

Recorders of the gradient of the electrical conductivity of the soil;

A standard meteorological set;

Equipment for hydrological measurements;

Magnet meters;

Counters of aerosol particles;

Seismic receptors, and others.

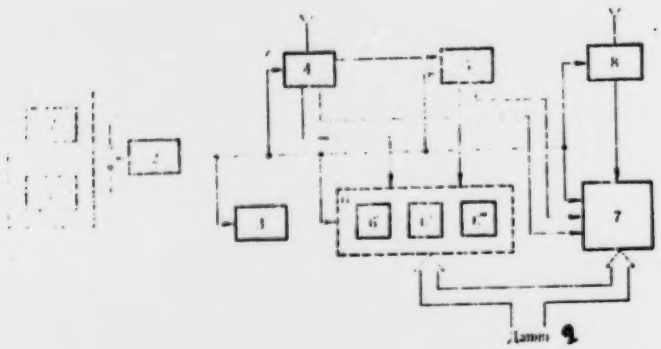

Figure 1. Most general block circuit of the apparatus in one of the PNSSSI variants:

1. Prime electric power: 1'--battery; 2"--power grid;
2. Secondary power supply;
3. Location identification equipment;
4. Precise time measurement system;
5. Programming system;
6. Independent recorders: 6'--tape recorder; 6"--photographic recorder; 6'''ink recorder;
7. Data gathering system;
8. Ultra shortwave radio;
9. Data

The data gathering system (SSD) consists of a central point (TsP), installed in the PNSSSI, and four peripheral points. In most general terms, the principle of action of this system is based on the automatic engagement of the individual peripheral points and the telemetric transmission of data which is received and recorded in digital figures in the TsP. The location and distance of the individual peripheral points are based on the nature of the terrain which affects such ultrahigh frequency transmissions. The TsP records, provides the initial processing and the visualization of the data.

Autonomous recorders: tape recorders, photographic recorders, ink and heat recording instruments, and others.

Location determining apparatus: various geodetic instruments such as a theodolight, a compass, and others.

Single accurate time system: electronic clock with a quartz generator and built-in radio receiver for making automatic corrections based on standard accurate time radio signals.

Official radio communications: portable radio telephones operating within the ultrashort frequency range, which provide radio communications between the individual units of the research complexes in the case of combined studies involving laboratories aboard airplanes and helicopters, and so on.

Service equipment: the most necessary apparatus and instruments for control, tuning and repair under field conditions.

Thanks to its functional nature and flexible structure, with minor equipment changes, mainly in terms of the measuring equipment, such a mobile station may be used for comprehensive as well as strictly specialized studies in all geonomic areas--geophysics, geology, geography, hydrology, meteorology, environmental protection, and so on. It may be also used for purely technical and engineering studies, such as in engineering seismology, vibration measurements, meteorological measurements, and others.

5003
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MORE ACTIVE RESEARCH IN SOLAR ENERGY FIELD ADVOCATED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 3, 1982 pp 30-37

[Article by Prof Stefan Kunev: "Problems of Solar Power Industry"]

[Text] The question urgently arises of finding new and clean energy sources in connection with the energy and environmental protection problems affecting virtually all countries. In this sense, particular attention is being paid to the sun. As a source of energy, it may be described most generally speaking as follows:

1. It supplies the earth with huge amounts of energy (about 10 kilowatt hours per year, or 10,000 times the current energy requirements of mankind). In no more than a few weeks the earth's surface receives as much energy as would be generated by the use of all available energy resources on earth. Estimates have indicated that the area covered by a modern energy production unit (a thermoelectric power plant for example) is larger than the area receiving the same amount of solar energy on an annual average.

2. Solar energy is virtually inexhaustible, and resolving the problem of its tapping for purposes of large-scale energy production will resolve the energy problem of mankind forever.

3. The sun is a clean source of energy which can never result in environmental pollution.

4. For the time being no basic difficulties of scientific or applied nature exists related to mastering the use of solar energy.

The mastering and conversion of solar energy may be accomplished with the help of several already known basic methods.

a. Its transformation into electric power through semiconductor photoelectric or thermoelectric generators (solar batteries);

b. Through the photolysis of water resulting in the production of hydrogen, which is considered one of the most promising and clean fuel gases and an ideal storage of energy during sunless periods;

c. Through the absorbtion of solar energy by systens with large blackened surfaces (so-called heat collectors) and the use of the thermal energy thus obtained for residential, industrial and other needs;

d. Through the concentration of solar energy with the help of mirrors and the use of high temperature systems;

e. Through the use of the biological effects of photosynthesis, photolysis of water with biomembranes, and others.

It would be natural to expect that with such an apparent tempestuous development of solar energy that new even less expensive and more convenient methods will be discovered and used. Some of the currently existing methods are already being applied while others are considered quite promising. According to authoritative specialists in this field, the direct conversion of solar into electric energy is the main direction offering the best opportunities for resolving major energy production problems. The development of electric power plants based on photoelectric batteries offers a number of advantages. Such installations operate at low temperature, noiselessly, during sunny or cloudy days, without moving mechanical parts, covering relatively small areas. They also guarantee absolutely clean air.

The main scientific problems related to solar energy today are the following:

1. The development of technologies or new designs for the large-scale production of inexpensive photoelectric elements and batteries. Their cost must be reduced by a factor of 30-50 before they can compete with modern power industry equipment. No basic difficulties exist for the solution of such problems and the forecasts are clearly optimistic. It is believed that the existing scientific and technical problems involved can be resolved within the next 5 to 15 years.

2. The development of high capacity solar power plants on the basis of lower-cost concentrators. This problem may be resolved in the reasonably distant future.

3. The development of thin layer selective and protective covers with improved efficiency and technological qualities. Such covers will increase the efficiency and lifespan of the solar collectors, mirrors, phototransformers, and others.

4. The further development of existing physical and physical chemical principles for the production of inexpensive hydrogen through water photolysis, which will be used in storing the energy of the fuel gas.

5. Increasing the efficiency and lowering the cost of semiconductor thermoelectric and thermal pumps.

6. Improving thermal batteries and systems by using phase conversions into solid state, and others.

7. Development of even less expensive collectors and other thermal systems based on new physical principles.

8. Improving the efficiency of photosynthesis and other photobiological processes.

In addition to scientific problems, many other problems of technological and engineering design nature must be resolved in order to make possible the rational and efficient utilization of solar energy. All in all, for the time being, the limitation restricting the mass use of solar energy has been the high cost of equipment. The problems require expanded activities by large collectives (even involving the participation of several countries). With this in mind, in recent years an increasing number of countries have undertaken scientific research and applied activities related to the use of solar energy. National programs have been drawn up by Japan, the United States, the USSR, France, the FRG, Austria, Australia, Romania, Turkey, Yugoslavia, Italy, Spain, Belgium and many others. At the same time, international orgnizations have focused a great deal of effort to combine and enlarge the activities of individual countries in the solar energy area. For example, since 1976 work has been done along the CEMA line on a program for the use of solar energy and new energy sources. The member countries are participating in the long-term plan for cooperation on this problem with respective scientific research and applied developments. A plan is being enacted for building a facility for joint testing of equipment and systems aimed at converting solar, chemical, wind and geothermal energy into electric, heat, mechanical and other types of energy. A draft long-term program for cooperation through 1990 is being formulated.

Work in the solar energy field calls for the building of electric power plants based on thermodynamic and photoelectric principles, the construction of solar buildings, the improvement of heat transforming and storing systems, and others. Solar energy problems are being developed on a broad scale mainly in the USSR. Scientific and applied problems in this area are considered of prime significance and are being resolved on a high scientific and technical level. The USSR is participating in the CEMA program as an active partner with great possibilities and willingness to cooperate. Various scientific research centers are working on virtually all aspects of the solar energy problem on which research has been underway for a number of years. The construction of the first experimental 5 megawatt solar thermoelectric power plant is currently under construction. The construction of a new 100 megawatt electric power plant is contemplated on the basis of the experience which will be gained.

Among the other socialist countries Romania is particularly active in this area, as confirmed in the reports and plans submitted to CEMA.

Some European members of the European Economic Community (EEC) are coordinating their activities with the program for joint development and exchange of technology in the field of solar energy. The EEC program was adopted as early as 1975. As a result, an experiment with two solar electric power plants, each generating a capacity of 500 kilowatts, operating on a parallel basis, was launched in Spain in 1981. The first is based on the thermodynamic and the second on the photovoltaic conversion principles. The projects were based on the results of the joint research and development efforts of the EEC members.

UNESCO has a five-year program for assisting developing countries in research and applied activities related to the utilization of solar energy for the period between 1977 and 1982, with an overall budget of $1.5 million.

Several examples of financing national programs in the advanced countries indicate the scale on which such activities are being developed. Thus, for example, the sum of 10^{12} yens has been appropriated for the Japanese Sunshine program; in 1979 France spent 276 million francs, 165 million of which on science and development. The same year Italy appropriated more than 1 billion lira for photovoltaic transformation alone. The FRG, a country with a relatively low amount of solar energy, appropriated $70 million for the 1976-1980 period. The U.S. government appropriated $74 million for photovoltaic transformation alone for the fiscal 1982 and is planning to spend about $250 million for new energy sources in 1983; about $150 million of which will be on solar energy alone (50 percent of it for photovoltaic conversion).

Currently the use of solar energy for a variety of purposes is growing: desalinization of sea water, dehydration of agricultural commodities and quarry materials, and solar greenhouses may be found throughout the world. Hot water systems are being increasingly widespread in camps, resorts, sports installations and residential and industrial projects, for they lower in real terms annual energy consumption by as much as 50 percent. In Japan alone more than two million such installations have been installed. A number of developing countries have installed large numbers of pumping and irrigation systems powered by solar electric generators. The number of private and public building heated with solar energy is increasing in the United States, France and the USSR. In 1985 France alone is planning solar energy supplies for one million housing units, increasing it to 30 percent of all housing by the year 2000.

The direct transformation of solar into electric power is also gaining increasing support. Whereas until recently it was believed that the use of photovoltaic generators would remain limited (meeting the needs of isolated distant projects), during the last 3 to 4 years there has been increasingly frequent talk of industrial capacity systems. In the United States, which is a leading country in this direction, 7,000 square meters of solar batteries were produced in 1977 and 10,000 in 1979, generating a total power of 2 megwatts. By the end of 1982 17 photovoltaic solar power plants will be completed with a unit capacity of 20-500 kilowatts, with an overall generating capacity of 2.3 megawatts. The overall capacity of the power plants is expected to reach 2,000 megawatts by 1990 and 5,000 megawatts by the year 2000. In 1979 France produced solar batteries generating a total of 400 kilowatts; in the past 2 to 3 years it has commissioned 70 photovoltaic systems with a unit capacity ranging from 1 to 100 kilowatts. Currently Japan is building two photovoltaic solar power plants (of 1 megawatt each). By the end of the century the overall capacity will reach between 7,000 and 11,000 megawatts. Many countries have low power systems in operation, the results of which will be used as a basis in designing larger similar projects and drawing forecasts. The number of solar electric power plants with a thermodynamic conversion cycle is also increasing. As early as 1979 an electric power plant with a 1 megawatt capacity was com-

pleted in California; a second was commissioned in 1980, generating 10 megawatts. In France a solar electric power plant of the "tower" type, generating 3.5 megawatts was commissioned in 1981; a 1 megawatt power plant was commissioned in Adrano, Italy; a power plant generating 250 kilowatts is operating in Spain (not far from Madrid), and so on. Power plants of small or medium capacity are planned to meet the needs of the developing countries in Asia, Africa and Latin America. Actively participating in such efforts are countries such as Austria, Israel, Spain, Italy and others. Intensive efforts are being made in this area by the USSR and Romania.

What are the prospects and the expediency of the use of solar energy in Bulgaria?

Bulgaria is a country with rather limited organic and hydrolic resources (according to some data it has a per capita amount of energy one-tenth of the average worldwide level). Unquestionably, the energy problem will rise sharply in the next few years. This justifies the interest in the possible tapping of solar energy in our country. However, the assessment of the expediency of such developments must be preceded by a consideration of the specific characteristics of the individual countries in terms of their climatic, material-production and scientific potential.

Bulgaria is located within a very narrow geographic latitude--41-43 degrees northern latitude. For this reason, differences in the radiation regime between the individual areas are small and are determined mainly on differences in the cloudiness regime. Because of its southern location and relatively small cloud cover, Bulgaria receives a considerable quantity of solar energy located in the so-called "sun belt." The annual amount of sunshine ranges between 2,200 and 2,400 hours.

A simple estimate proves that it would suffice for no more than 1/500 of Bulgaria's territory, i.e., 200 square kilometers, to be covered with installations for the transformation of solar energy (using photoelectric batteries with a 10 percent efficiency, for example) to satisfy the country's annual electric power outlays (taking 1980 as an example--3.6×10^{10} kilowatt hours per year).

Based on most general considerations in comparing data on solar radiation with some European countries with a developed intensive scientific and production activity related to the use of solar energy (the FRG, France, Belgium, Austria and Romania), we could confidently say that Bulgaria has all the necessary climatic conditions for a profitable development of solar energy.

As to scientific research, design and applied activities in tapping solar energy, we have grounds to believe that they would require relatively modest financing and no specialized industry. Naturally, if we are not discussing the production of energy through artificial satellites but autonomous solar systems and installations and ground energy producing solar centers, this is entirely within the range of our country's possibilities.

For purposes of "small scale energy industry," in a country with a strongly developed international tourism, vegetable and fruit production, tobacco,

and so on, flat water or air collectors can be successfully used for purposes of heating, hot water supply of resort areas, beaches, greenhouses, tobacco curing, etc. Based on acquired experience and computations, with proper construction, their use in so-called solar architecture could account for nearly one-half of the energy needed for heating and hot water supplies (naturally, following the recovery of production costs).

The use of photoelectric batteries for local electric power supplies is of essential importance as the initial stage in their use in the power industry. Solar electric power plants of low or average capacity could be built during the current decade. The lowering of their construction cost, however, would require considerable scientific research and development efforts. The importance and prospects of this type of solar installations have already been discussed.

The use of more powerful energy systems such as solar thermoelectric power plants is of interest. We could begin even now to experiment with a plant developing a few dozen kilowatts and, between 1985 and 1990, develop significantly higher capacities. The production of hydrogen, which is both an energy carrier and storer, is a more distant but quite tempting prospect.

Generally speaking, the development of an intensive purposeful scientific research and applied activity in Bulgaria, related to the tapping of social energy, is entirely timely and necessary.

Currently our country has two basic units engaged in specific work in this area: the New Energy Sources Scientific-Production Economic Combine (NPSK "NEI") of the Ministry of Power Industry, which is engaged in the development and production of water solar flat collectors and various heat installations on their basis. These are systems for water heating for a number of industrial, agricultural, tourist-residential and other projects.

The other unit is the Central Laboratory for Social Energy and New Energy Sources (TsL SENEI) of the Consolidated Physics Center of the Bulgarian Academy of Sciences.* It began its activities in 1978 and has a personnel of about 35 members. Within a relatively short time it was able to organize its activities and to begin work and obtain substantial scientific and practical results. In the past and currently it has focused on two basic topics:

1. Photometric transformation and utilization of solar energy (heat production), which involves scientific and technical problems related to the direct practical application of various types of systems, methods and installations.

2. Photoelectric transformation and utilization of solar energy (electric power production), in which most assignments are related to the future activities of some of our plants and the practical development of photoelectric systems.

*The activities of this laboratory are considered in greater detail in this article for it is part of the activities of the Bulgarian Academy of Sciences.

Interesting results were obtained in the course of the development of these two basic topics in the area of instrument manufacturing and measuring equipment, which led to the application and the undertaking of new production activities.

Along with the dozens of publications and authorship certificates, the TsL SENEI collective obtained the following more important results related to practical applications:

An aerial solar collector with improved indicators (Authorship Certificate No 29,979) was developed and tested. It produces hot air for farming, industrial and household needs;

Together with the ITTI in Plovdiv an experimental solar tobacco curing system with a 3-ton capacity was built. The results of its operation are used in expanding this type of construction;

A collector system for an evaporative installation was built jointly with NIPRORUDA in Shkorpilovtsi Village, Varna Okrug, for the production of iodine, bromium and other valuable elements contained in geothermal waters;

The designing of a large (400 kilowatt nominal capacity) solar dryer for agricultural commodities was completed in Kaloyanovo Village, Plovdiv Okrug, on contract with the G. Dimitrov NPSK [Scientific Production Economic Combine];

A technology was developed for fine-layer selective covering (Authorship Certificate No 30,105, and request for Authorship Certificate Registration Nos 42,540 and 46,430), of great importance in upgrading the efficiency and durability of solar equipment. They will be applied by the NEI NPSK and other enterprises using black galvanic covers;

A technology has been developed for the production of a heat resistant black paint (request for Authorship Certificate Registration No 51,132), applicable in solar collectors of different types (including those produced at the NEI NPSK), in industry and art. It can be produced by Lakprom. This paint was used in the building of the systems we mentioned;

A nonselective radiometer (Authorship Certificate 47,911) was developed, for determining the radiation energy from ultraviolet to far infrared, applicable in solar technology, radiometry, automated energy systems, and others. Production in small series will be undertaken next year;

A technological variant has been developed for the manufacturing of silicium photoelectric converters (photoelements) with a 15 percent efficiency, for laboratory samples (request for Authorship Certificate Registration No 47,741). They are made of defective silicium washers from the production of integrated circuits at the Semiconductors Plant in Botevgrad. The purpose is to make use of a large number of expensive imported material using the existing technological systems at the plant without changes;

A light-sensitive material has been developed on the basis of cadmium sulfide and, on its basis, a technology has been developed for the production of light

resistors with a differential outlet (Authorship Certificate No 19,338), applicable in solar tracing systems, computers, and others. Such light resistors have been applied at the Plovdiv OZZU [Consolidated Plants for Memory Systems] and have been in regular production for the past few months. They replaced a certain type of imported light resistors, compared to which they provide faster action. The OZZU is making preparations to undertake the production of light resistors next year;

An instrument for the fast definition of parameters of solar light elements has been developed. Its production in small series will be based on requests submitted by CEMA-member countries and in connection with joint work done on this problem.

The following have been developed as well:

A method for determining the coefficient of (nesthyometry) of a hydrogen-oxygen mixture (Authroship Certificates Nos 29,413 and 29,694);

CVD technology for the production of amorphous silicium, applicable in solar photoelements (request for Authorship Certificte Registration No 50,449);

Method for electronic sorting by color of industrial samples and for technological control in the coloring process in various industrial sectors. Successfully tried at the "8 Mart" plant in Sofia;

The TsL SENEI is carrying out some work of organizational nature. It is the coordinator in Bulgaria and in charge of one of the CEMA problems on "Development of New Efficient Methods for the transformation of solar, chemical, wind and geothermal energy into electrical, mechanical and thermal energy and the delopment of corresponding systems and installations." The TsL SENEI organizes and implements measures related to the forthcoming construction of a Soviet-Bulgarian testing area for new energy sources in Michurin.

The laboratory organized a UNESCO conference on the creation of a consultative council on solar energy for Europe, which took place in Varna in 1978.

The laboratory personnel dedicated a great deal of effort and enthusiasm in carrying out these assignments. A substantial number of difficulties of most various natures, typical of any new activity in the lack of adequate cadres, equipment, materials, work premises, and so on, were compensated for by additional efforts. Thus, for example, the lack of equipment and technological facilities forced the laboratory personnel to use the equipment of the Semiconductor Plant in Botevgrad, whenever this did not interfere with the plant's work. Despite the difficulties it created, the lack of some equipment was of positive significance, for it created prerequisites for designing new methods and instruments.

A comprehensive program was developed for the activities of the country related to the use of solar energy through 1985. Furthermore, a scientific and technical forecast through 1995 was drafted.

Being a small country, Bulgaria must focus its efforts on scientific research and application activities in a lesser number of directions in the field of solar energy, those which are more profitable and require lesser funds. For this reason, it would be expedient for the TsL SENEI to continue its work along the two basic directions, as in the past.

These results provide a base for expanding the scientific activities of the laboratory and its efforts to apply in industry and construction experimental, semi-industrial and industrial solar energy systems. Furthermore, it would be expedient to continue and increase efforts to develop and apply more efficient types of light resistors, radiometers, tracking systems, and others.

More specific activities directly related to practical use are the following:

During the next and subsequent years we shall undertake the construction of industrial systems for curing tobacco and desiccating agricultural commodities and industrial raw materials. A contract has been concluded to this effect between the TsL SENEI and the OAPS in Blagoevgrad, for the construction and commissioning in the summer of 1982 of a tobacco curing installation which will be used in the spring in greenhouses for early vegetables. The 1982 NIPRORUDA plans include the joint construction with the TsL SENEI of an evaporation system for the production of kaolin (within the "kaolin" program) and of a drying installation for the production industrial quarry materials. According to TsL SENEI, again with its help, in 1982 the G. Dimitrov NPSK will undertake the construction of an industrial drying system for agricultural commodities.

The construction and the study of the work of such systems will enable us to improve and apply them on a broader scale during the present five-year plan. The drying of grain feeds, ensuring their lengthy preservation, is a particularly important problem. This will make necessary the series production of air collectors at the NEI NPSK by the Ministry of Power Industry, developed by the TsL SENEI.

In 1982 and later work will be done on improving the already developed air collectors and the building of high temperature collectors and concentrators with a view to the construction of insulations for hot air and steam needed by some industrial sectors for the production of concrete elements, in the canning industry, timber processing, etc.;

Experiments will be conducted with regenerative heat exchange systems used in preserving the heat which is released along with moist or polluted hot air by the heat generators and premises in various production facilities (such as drying equipment in various industrial shops, and others);

Work will be done to develop even more efficient selective and non-selective covers, such as a nonselective black paint produced by Lakprom for the NEI NPSK and other industries. Furthermore, experiments will be conducted to apply selective covers in industry;

Work will be continued on developing an industrial technology for silicium photoelements from waste silicium washers at the Integrated Circuits Plant in

Botevgrad. On this basis, or on the basis of imported photoelements and modules, the construction of a small experimental solar photoelectric plant may become possible in 1983, in order to obtain actual data on the operational possibilities and construction of such installations under Bulgarian conditions and their application during the five-year plan in some separate energy units (radiorelay stations, electronic calculators, water pumps, cattle breeding stations, etc.);

The technology for the production of amorphous silicium and fine-layer cadmium sulfide and photoelements made of them will be continued with a view to the development of inexpensive solar photoelements and batteries;

The TsL SENEI has the opportunity to apply new types of photoresistors (Authorship Certificates Nos 24,640 and 24,385) to meet the needs of automated equipment. Furthermore, it would be expedient to improve the developed radiometer and its production. To this effect and for the purposes of the solar tracing systems, it is imperative to continue and increase the work of the laboratory on instruments for solar tracing systems and of automatic equipment for radiation measurements;

Bearing in mind the fluctuations in solar radiation, the heat battery is the main element in various solar installations. Virtually no work is being in this respect in our country. This could be developed either at the TsL SENEI or the NEI NPSK.

No serious work has been undertaken in our country in the field of solar architecture. The future construction of housing and industrial buildings should be adapted functionally to an eventual addition of solar installations. Furthermore, one of the units of the Ministry of Construction (in cooperation with the solar energy units) should undertake work on the construction of buildings equipped with systems for the active and passive use of solar energy.

It would be expedient as of now to undertake preparations for and study of the construction of a new experimental solar thermoelectric power plant (eventually at the end of the present and the beginning of the next five-year plan).

Naturally, such activities cannot be developed or assisted by the TsL SENEI given its current cadre and material facilities. Greater concern and feeling of responsibility are needed in order to stimulate the work related to mastering the only significant energy resource at the disposal of our country.

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CSO: 2202/2

CHRONOLOGIES, INSTRUMENTS, EQUIPMENT DESCRIBED

Sofia SPISANIE NA BULGARSKATA AKADEMIYA NA NAUKITE in Bulgarian No 3, 1982 pp 93-101

[Text] Methods and systems for planetary feeding of continual electrode in first, second and third generation IZAPLAN welding.

During the past 20 years qualitative developments have taken place in the technology of the electric arc welding process through the use of welding methods in a protective environment provided by an inert or active gas (MIG and MAG).

Development of these methods contributed to the automation and robotics in electric arc welding. Even semiautomated systems doubled and tripled their productivity, reduced material outlays by about 30 percent and improved the quality of the welds, particularly in dynamically stressed structures through the use of the MIG and MAG methods. The welding of aluminum, nonferrous metals and alloys became possible with the help of mechanized electric arc systems.

The mechanical feeding of an electrode to the welding arc is the basic problem in the application of the new methods (MIG-MAG).

Classical Feeding of Continuous Electrode

The classical solutions developed by more than 435 companies and institutes are characterized essentially by their heavy and complex design based on trivial kinematics. In this case the electrode wire is fed by two or four cylindrical wheels (1.1 and 1.2) with axles perpendicular to the cylindrical electrode which is pushed out (Figure 1). The rollers are powered by an electric motor through a reduction gear with a high conversion ratio and low efficiency. Because of the position of the cylindrical wheels compared to the electrode, they achieve spot contact with a small area. The organization of the interaction between the working wheels and the electrode takes place through normal pressure which is necessary for the creation of a driving power. However, because of the spot contact in all cases this takes place at the expense of the deformation of the electrode and the creation of internal stress within it.

Therefore, these solutions contain a number of shortcomings which result in an increased resistance in the subsequent crossing of the electrode through a

flexible trailing cable, as well as the fast wearout of parts (contact nozzle). Furthermore, the continuous electrode rolled in a bobbin (Figure 2) comes out bent in the direction of the trailing cable which leads to the arc, which creates additional resistance. From the technical viewpoint, we are faced with a "vicious circle"--the need for a maximal pushing force to surmount the resistance of the maximally long trailing cable, on the one hand, and the application of normal pressure for feeding with increased power, on the other, which deforms the electrode, creates a stress within it and thus increases the resistance within the cable. A number of other shortcomings inherent in this method limit the practical application of the MIG-MAG welding methods as would be the case in the manufacturing of construction, ship (karni) and other structures and particularly robotic systems which require long welding seams. The best classical methods known so far have a limited feeding distance (not exceeding 4 meters).

Based on theoretical and practically tested studies, a new kinematic system was developed in our country in feeding a continuous electrode. It makes use of the planetary reduction of the rotary movement of the engine in feeding the con-tinuous electrode.

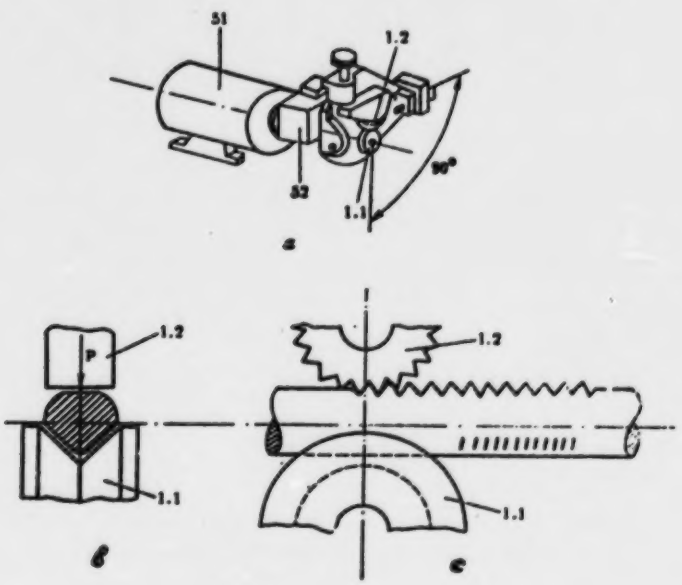

Fig. 1

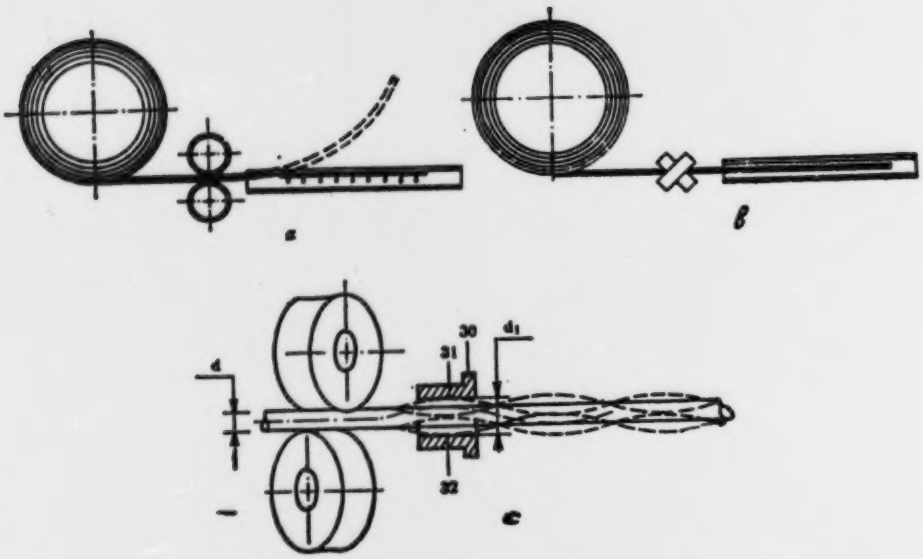

Fig. 2

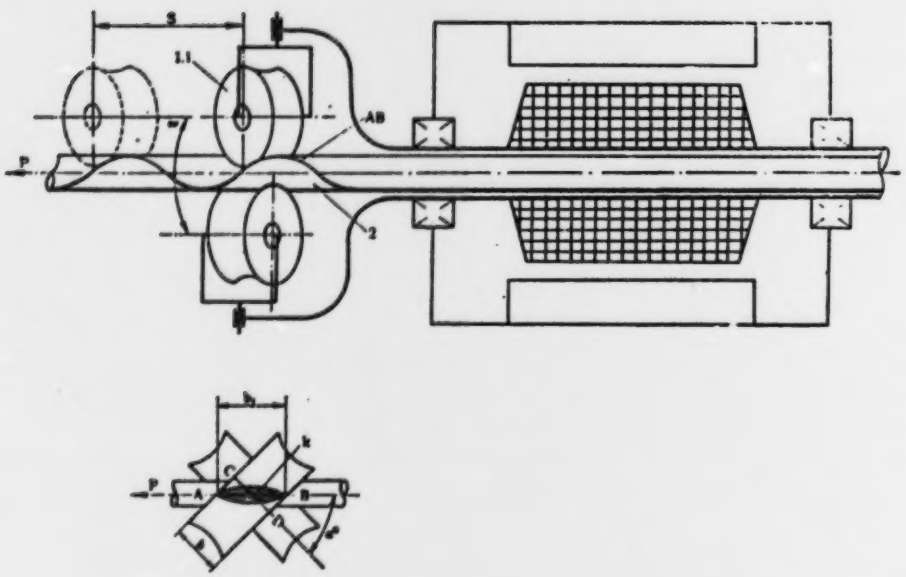

Fig. 3

Planetary Feeding

The system consists of no less than two hyperboloidal wheels 1.1 and 1.2, which rotate in a planetary fashion around the nonrotating cylindrical electrode 2, in a thread line 3, with an interval governed by a permanent or controlled angle between the wheel and the continuous electrode (Figure 3).

The feeding speed is determined by the planetary reduction of the rotating planetary turning of the electrode by rollers. This reduction is determined by the angle between the rollers. With a permanent angle the feeding speed should be constant.

In this case the speed is controlled by changing the revolving speed of the engine. In this kinematic dependence the feeding speed is proportional to the speed of the engine (rotary planetary wheels around the electrode cylinder), the diameter of the electrode and the angle of inclination of the rollers.

Since the planetary wheels are hyperboloid they establish linear contact between the frictionally interacting working wheels with the cylindrical electrode. The theory of the crossing of two cylinders in a space curve--a hyperbole--has been used. Each straight line, which marks the hyperboloid surface of the working wheels is a line of contact between the same and the electrode. Under the pressure of the two working wheels leading to the electrode cylinder a wide contact spot develops. This area determines the high pushing effort.

The rounding of the electrode cylinder by the two hyperboles creates conditions for the plastic deforming of the electrode, eliminates internal and external pressures affecting it, and straightens it out. Studies have indicated that in this manner the electrode enters the flexible cable with a lowered resistance.

Added to these studied and practically confirmed advantages is the additional vibration effect which is the result of the revolving of the electrode cylinder by the working wheels. Figuratively speaking, after it has been fed, the electrode vibrates like a string and moves like a "snake." The movement of a snake is a natural phenomenon and is related to the lowest possible resistance while entering the flexible hose. All of this doubles the length of the flexible hose, as a result of which the efficiency of MIG-MAG welding machines reaches a wide perimeter, i.e., a qualitative leap is achieved in the application of automatic welding methods.

Studies made of the dynamics of planetary friction transmissions in feeding a continuous electrode made possible the creation of second generation systems. Here the necessary measures were taken to compensate for the harmful consequences of parasitical centrifugal forces in the new kinematics, on the one hand, and obtaining a steady pushing force on the electrode at high feeding

speeds, on the other, in which the friction coefficient is reduced. Thus, in the second generation a design was developed ensuring a permanent pushing force within the entire range of feeding speeds and welding systems. Furthermore, this brought about a record-setting level of evenness of 2.5 percent (1 percent in robots) with a standard possibility for classical systems and first generation systems of 10 percent.

The further development of the third generation system involved the use of another technical consequence based on the nature of the new kinematics. Unlike the classical systems, in which the rotary transmission from the engine to the electrode takes place through a mechanical reduction gear the planetary method ensures the direct transmission of the same. The lack of a reductor enables the planetary wheels directly connected to the axle of the engine and together with the engine to be used as a recording instrument for the mechanical resistance in the hollow cable.

This characteristic was used in the creation of a tandem system (mastersleyf) of two wire-feeding systems operating along both sides of a lengthy flexible cable. The first, which is closer to the welding arc, is used as a recorder which, with an increased resistance, develops a feedback with the second system whose speed is variable and depends on the load of the first. This simple interacting system ensures the increase in the distance of feeding a continuous electrode by a factor of 7, with an even feeding consistent with the second generation. The third generation of planetary feeding is known in its two modifications--IZAMODUL and POLIZAPLAN.

In the course of the further development of planetary friction feeding, attention was paid to some necessary applications in robot welding systems. These systems, known as the fourth generation, use the electromagnetic tuning of the planetary wheels based on the diameter of the electrode and the force of the feeding. The necessary control of the normal pressure on the planetary wheels on the cylinder-electrode is done electrically. This makes it possible to include in a robot program both the type of material supplied (steel, pipe wire or aluminum), as well as its diameter. This ensures control over all the parameters of the process.

The method of planetary feeding of a continuous electrode is a Bulgarian invention named IZAPLAN. It was used for the first time in our country in 1965 and its subsequent new developments were patented between 1971 and 1973 in 18 different countries. Within that period the method and systems obtained 150 foreign patents and patented publications owned by the Institute of Technical Cybernetics and Robotics (ITKR) of the Bulgarian Academy of Sciences. The high technical parameters of the method were noted by leading countries and firms in the field of welding. In 1975 the Bulgarian Tekhnika Foreign Trade Organization sold a license for first generation systems to the Polysoude Company

(France), belonging to the Phillips concern, and to Messer Grisheim (FRG) belonging to the Hoehst concern. Subsequently, through Polysoude the Cyclomatic Company in the United States applied this method in America.

Along with mastering production in foreign companies, the first generation method and systems were successfully applied in 1977 at the Optikoelektron Machine Building Combine in Panagyurishte, which produced and exported more than 20,000 modules and systems. By 1981 substantial foreign exchange had been earned (21 million foreign exchange leva) and savings totaled about 12 million leva.

The second and third generations developed at the "Robot Welding Systems" section (ITKR of the Bulgarian Academy of Sciences) developed in 1979-1980 made possible the mastery and production of 18 modified IZAPLAN-II, IZAMODUL and POLIZAPLAN systems at the Sasho Kofardzhiev Experimental Base. The results were astounding: the second and third generation systems produced in Bulgaria, successfully competing with the first generation, produced in France and the FRG on Bulgarian licenses, were purchased by a number of companies (Niemack--FRG, Hulfteger in Switzerland, TWS in England, MIC in Belgium, Arcos in Italy, Ramon-Ramon in Spain, MIGOMAT in Australia, and Osaka Denki in Japan). Currently Bulgarian wire feeding systems hold all world records in the area of the most important welding parameters.

Bulgarian wire feeding systems earned seven gold medals at a number of international expositions of inventions and new equipment and specialized exhibits of welding innovations (in Geneva, Brussels, Nuremberg, Leipzig, Zhilina, Plovdiv and Brno).

At the present time, thanks to this Bulgarian scientific and technical accomplishment, more than 15 percent of all MIG-MAG operating equipment in the world is using planetary welding systems, i.e., 5 years after they were initially applied in Bulgaria and abroad. We hope that this is the result of the studied and confirmed technical advantages of the new method, which may also be the reason for welding engineers in the advanced countries to continue increasingly to apply our results in the field of this "magic"--arc welding.

By Senior Scientific Associate David Samokovliyski

Lens and Optical Data Recording and Processing Systems

Based on a new method for synthesis and computation of fourier-lens and coherent optical systems, the Central Laboratory for Optical Information Recording and Processing (TsLOZOI) of the BAN [Bulgarian Academy of Sciences] has made 12 inventions, six of which jointly with the Leningrad Precise Mechanics and Optics Institute (LITMO) and one with the USSR Academy of Sciences. The authors are Scientific Associate Engineer I. D. Nikolov TsLOZOI BAN) and Prof M. M. Rusinov and S. A. Radionov (LITMO--Leningrad).

Based on the joint inventions Registration No 47,568 "Lens Orto-Rusar-4" and Registration No 50,546 "Optical System," contracts are being drafted for joint patenting and licensing in the United States, Canada, Japan, the FRG, the GDR and France.

For the first time in world practice qualitatively new orthoscopic telecentric lenses with an ortho-Roussar-type removable pupil have been computed. They offer great advantages in work with coherent systems for fourier recording, reading and interpretation of data with increased compactness and reduced distortions. The original lenses and optical systems for data recording and processing are based on the modular principle: a base orthoscopic element and an anastigmatic apparational compensator.

In addition to optical and holographic data recording and processing, the ortho-Roussar lenses can be used in laser systems, microelectronics, cartography, machine building, photogrammetry, space research, and others.

The development has been applied at the BAN. The TsLOZOI has developed two one-of-a-kind ortho-Roussar-2M systems for various scientific and applied research, such as the development of highly efficient holographic filters in data recognition systems, the creation of adaptable optical processors for fast data processing, the development of optical-electronic memory systems with large memory banks, the testing of holographic difraction grids in earth telemetric electrophotometric systems. According to Soviet data the cost of a single such lens is 12,000 rubles.

The use of ortho-Roussar lenses in Bulgaria will save on foreign exchange and will improve the quality and efficiency of the optical systems developed in the country for computer equipment.

Automatic Fiber Extinguishing System (SAP)

The automatic fire extinguishing system is an invention (Registration No 49,071/1980) created and made at the Institute of Technical Cybernetics and Robotics of the BAN by a group of authors as follows: from the BAN: Senior Scientific Associate N. Milev (head), Corresponding Member A. Angelov, Engineer G. Kirilov, and Engineer E. M. Veselinov; and from the Central Fire Prevention Savety Administration of the Ministry of Internal Affairs, Engineer Khr. Nenchev, Engineer G. Penchev and Engineer T. Shopov.

The fire extinguishing agent used by the system is carbon dioxide. It involves an electronic system for signaling, selective direction of the action of the system and a structure for active weight control of the amount of carbon dioxide.

The automatic fire extinguishing system (SAP) will be used for the automatic extinguishing of fires in premises the very moment the fire breaks out, extinguishing it within no more than 3 minutes. The advantage of the system is that it protects two premises with enhanced operational safety. The system is applied in the comprehensive extinguishing of fires in premises containing extensive equipment and materials and areas with increased fire risk such as

computer centers, book repositories, paint shops, special production facilities, and others.

The instrument went into regular production in November 1980 at the experimental base of the BAN Institute of Technical Cybernetics and Robotics. This terminated the import of similar fire extinguishing systems from capitalist countries, which has saved the country substantial amounts of foreign exchange. Annual savings total 1,385,000 leva. Great interest has been shown in this instrument on the part of the USSR. In 1982 the first Bulgarian system for automatic fire extinguishing with carbon dioxide will be commissioned in Moscow.

System for Automatic Control of the Technological Process at the Betonkontrol Concrete Manufacturing Center.

A system for the automated control of the technological process in concrete assemblies has been created at the BAN Institute of Cybernetics and Robotics, headed by Engineer K. Tropolov (the purpose is to stabilize the consistency of the concrete mixes and to reduce fluctuations in the tensial characteristics of the concrete).

It is a module microprocessor system which automatically measures the moisture content of quarry materials (sand and felt), corrects the initial prescriptions for the manufacturing of concrete mixes depending on the established moisture level, automatically establishes the dose based on the amended recipes, and controls the technological stages in concrete mixing and preparations for transportation.

In terms of the precision of measurement of moisture, dosing, stabilization of the consistency of prepared mixes and productivity, the technical and economic indicators of the system are considerably superior to existing Bulgarian controlling systems and are on the level of the best systems applied by the leading firms throughout the world.

The system includes two inventions. In 1982-1983 twelve systems will be applied by the branches of the Ministry of Construction and Architecture. Possibilities exist of applying the system in many other economic organizations and departments engaged in concrete manufacturing.

The expected economic savings from the use of the system at the Gen. Galetski Plant for Construction Structures in Pleven is about 135,000 leva; for the country at large it will exceed 5 million leva annually. In addition to savings from the use of the Betonkontrol system, the working conditions of the operators at concrete mixing centers, who are now working in heavy dust environments, will be improved.

'Karobeta' Orange-Type Tomatoes

A collective at the BAN genetics institute, headed by Senior Scientific Associate Khr. Georgiev has developed a new strain of "Karobeta" tomatoes used

in the production of orange tomato juice with a high content of carotin and with a dietetic-prophylactic value and pleasant taste.

The "Karobeta" strain is a rare combination of a determinant habitus and orange fruits whose carotin content is higher by a factor of 6-8 compared with ordinary tomatoes. This is a top accomplishment in worldwide selection work. It is suitable for the use of the latest industrial technologies, including direct seeding and simultaneous harvesting. The strain is early, high yielding and resistant to the tobacco mosaic virus. Its average yield is 5 to 6 tons per decare.

The strain was applied experimentally in 1980 at the Bregovo Agroindustrial Complex in Vidin Okrug on 20 decares and at the Pordim Agroindustrial Complex in Pleven Okrug on 10 decares. During the 8th Five-Year Plan it will be applied on an industrial scale in the production of orange tomato juice for domestic consumption and export.

The use of the Karobeta strain is expected to yield considerable savings in the agroindustrial complexes, the canning industry and the export enterprises. The consumption of Karobeta-type tomato juice will be of great prophylactic importance in terms of the population's health.

5003
CSO: 2202/2

CEMA COOPERATION IN ENGINEERING CRITICIZED

Prague JEMNA MECHANIKA A OPTIKA in Czech No 9, Sep 82 pp 225-227

[Editorial: "CEMA 36th Session -- Stimulus for Intensified Cooperation"]

[Text] Another meeting of CEMA was held in early June, this time at the level of chairmen of councils of ministers of member states. This in itself is indicative that the program and its conclusions represent something out of the ordinary for the usual work of the council.

It is no secret that CEMA needed a stimulus for intensified work. This was the case because the orientation of the council's work, its scope and methods, have for a long time not corresponded to new needs and requirements. It is true that in 1972 the first secretaries of the central committees of our parties delineated a slogan and program of economic integration. There has, to be sure, been some improvement: so-called long-term target programs of cooperation have been worked out and there has been increased specialization in additional products and areas, but the basic problem still remains. We are still constantly faced with the problem of frequent lack of coordination of plans, in economic matters [each country] goes its own way, and frequent noncompliance with agreements sets off chain reactions in linked areas and economies. Although the basic basic directive on integration is still in effect, there has not been coordinated development of economic structures.

Evidence for this is provided by the following facts: Member states of CEMA have a 31 percent share of the world's population, 30 percent of industrial production, and only 8 percent of world trade. Their share in the production of basic raw materials exceeds their share in industrial production. We mine nearly half of the world's production of coal, 18 percent of its petroleum, and 35 percent of its iron ore, and produce 23 percent of world electricity and 39 percent of the world production of steel.

These facts are characteristic of the topics which we will discuss in the present article, written as a response to the 36th session of CEMA in Budapest. That is: the CEMA states belong to the group of economically developed countries; their production efforts are, however, focused more on raw materials and basic industry than on processing industry; a low share in world trade is evidence of poor connections to the international division of labor and underevaluation of both economic and scientific and technical cooperation.

Figures on our share in mining and raw materials production are also eloquent. Intensive economies are characterized by having large quantities of electricity and petroleum, which we lack; extensive economies are characterized by having a large production, which we have. It is interesting how few figures suffice to indicate our problems and, in the final analysis, those of the entire socialist camp.

This situation in itself lesds to a demand for the vigorous revival and intensification of an international division of labor and the implementation of true integration in the socialist camp, especially among CEMA member states.

We do not deny the possibility of increased international division of labor and economic relations with nonsocialist countries as well, but here our own efforts and readiness alone are not sufficient. We have always encountered discrimination measures in this area, with the leading role always being played by the United States, but today this concerns not only the United States but the individual EEC states. We are discriminated against collectively, in a planned fashion, and it is a question of global contingents of the entire EEC against all the socialist states, or the coordinated refusal to extend credit or prejudicial treatment in giving credit, for fabricated reasons of health and hygiene, or the like. These states are simply consolidating their own discriminating solidarity and cooperation. They divide us into favored and nonfavored, into those loyal to Moscow and those less loyal, and the situation is steadily growing worse.

At the CEMA meeting the following statement was made:

"The imperialistic circles of the United States and a number of other NATO countries have, with an aim toward developing political pressure, increased discrimination against CEMA member countries, and begun to use 'sanctions' and to limit trade and economic relations with them, especially with Poland and the USSR. They are intensifying the illegal policy of economic blockade of our brother Cuba. A declaration recently placed onto the agenda in Versailles indicates that the major capitalist countries intend to further complicate trade, credit and other economic relations with CEMA member countries."

There is of course no doubt that we will weather this out, that this is a repeat of the situation of the fifties, when the stimulus for imperialistic sanctions was the Korean War, or that of the sixties, when the alleged reason was the Cuban and the Berlin crises, but we still cannot remain indifferent to this new situation. After all, trade with the capitalist states continues to make up one-third of Czechoslovakia's foreign trade.

This is precisely why Czechoslovak economic circles showed such exceptional interest in the conclusions which were mentioned both in the proceedings of the last meeting of CEMA in Budapest and in particular in the speech by leader of the Soviet delegation, Comrade Tikhonov. At the meeting, this exceptional was conveyed by Comrade Strougal. And this is no small matter, as concerns the vital interests of the CSSR. Let us discuss this, following Strougal's address directly. We all know that the technical level in a number of production areas in the CSSR is lower than the world level. One of the reasons for this is that the large army of researchers and technical workers throughout the socialist

camp is not working in a coordinated manner but in parallel. scattering its forces and thus not achieving optimal results. Connected with this is the intensification of manysided campaigns for cooperation in science and technology, coordination of an integrated cycle involving research and development, production and utilization, and public measures for the development of new technology and for decreasing the dependence of science and technology on the developed capitalist states.

We all know the great importance of nationally agreed-upon action and long-term contracts. Every country is managed in accordance with them. We also all know the economic and political harm which can result from noncompliance by one side. It is therefore, in our opinion, extremely important that agreements and contracts concerning coordination be the starting point for a short-term economic policy of CEMA member states. This would prevent some solution chosen by one state from causing a chain of complications in the relations with its partners. Such coordination allows us to react resiliently to economic developments within individual states.

We must consider as an important and relevant measure, albeit an unwritten one, the agreement that great responsibility for fulfilling cooperative deliveries should become a law, in a legal and political sense, which allows for no exceptions or concessions and which functions as a reliable driving force in the mechanism of integration. The work of the council and its organizations was openly evaluated from precisely this viewpoint of functioning of the mechanism of integration, in order that the entire mechanism might function perfectly and be prepared to react to changes in market and production demands. The operation of the mechanism would benefit from increased integration at the level of ministries, associations and enterprises, as Comrade Leonid Brezhnev mentioned in his speech at the 26th CPSU Congress.

We must consider as the most important relevant issues of the recent meeting four significant manysided agreements concerning robotization, microprocessor technology, the components bases of microelectronics and color television. These useful and necessary agreements strengthen international socialist economic integration in significant areas. They are aimed at contributing to the growth of labor productivity and labor-saving, and at eliminating laborious production operations and work in unhealthy environments. The goal and common denominator of these agreements is to attain a peak technical level in these areas, primarily on the basis of our own strengths and mutual cooperation.

We consider these four agreements to be revolutionary in that we are very well aware that we lag behind in implementing this movement of the scientific and technical revolution, primarily because we have not mastered the components basis for assembly of finished electronic products, thus raising their technical and economic level. It is even the case that, under conditions of the production process in the economies of economically developed states of the world, electronics has been transformed overnight from an attractive branch of industry to a strategic factor in continued economic growth, which is ascribed a basic role in eliminating barriers placed in the path of effective functioning of the economy as a whole. The extent of governmental support of the development of the industrially most progressive states (the United States, Japan, the EEC),

and the fact that in the most liberal state economic systems programs of electronics are as a rule centrally followed, all only confirm this. It is even claimed that at present there are basically three conditions and key issues for growth: a sufficient energy supply, a large quantity of foodstuffs and future generation electronics. From this viewpoint, electronics in the CSSR is not a defective component or structural element of engineering but rather a multi-structural element of the entire Czechoslovak economy. Electronics is doing away with traditional production methods and technologies, fundamentally changing and developing sets of utility values, and changing the quality of social and labor conditions of people's lives. Within it there is forming a so-called "fourth" sector of the economy, the information industry, which is showing a tendency to become in the future the backbone of industrial development. A country will have claim to being eceonomically developed only if it subordinates its entire structure to this industry. This explains the reason and pressing need for priority growth of the electronics industry, not the fact that it somewhat "improves" the level of traditional areas and branches.

This was the particular viewpoint of the CEMA meeting in Budapest in discussing the role of electronics, and it is this particular viewpoint from which we will evaluate the significance of the above-mentioned four agreements and their content.

Intensified cooperation must follow the use of the specificity of electronics, which consists in an organic interface between the phases of development and production and in some cases in the joining of these phases with utilization of electronics output. This phase of electronics is exponentially increased by claims to specific demands for material inputs. In this connection the solution of such consequential problems by the forces of an individual member state of CEMA or through forms of cooperation thus far developed among CEMA member states is unthinkable. Most of the industrially developed states invest huge sums in such technology, and research institutes in this area employ as many as 10,000 people. There are six or seven firms in the world which can afford to expend such sums. It is definitely unthinkable that little Czechoslovakia might be able to expend such sums. The socialist camp, however, must expend such sums, for to continue to lag behind in this area means to subscribe to the economic backwardness of the economy as a whole.

Therefore, the main guideline of the current process of integration in electronics is considered to be a solution which utilizes forms of international association of research and development and production facilities, such as joint laboratories, production research associations and joint production facilities.

In the development of microelectronics, it is essential to master this path of the modern technology of production of highly integrated circuits, as well as to provide for sufficient special technological equipment to produce these. The output of this technological equipment is greatly in demand for research, development and production facilities. The Czechoslovak people may contribute to the joint solution of these problems, particularly in the areas of laser technology, x-ray and electron lithography, measurement devices, microassembly and layer technology.

A basic prerequisite for the develcpment of the production of electronics output is a supply of high-purity materials for microelectronics, the present dependence of the large majority of CEMA member states on imports of such materials from developed capitalist countries being strategically undesirable. The production of such materials calls for qualitatively new technologies and special equipment, the facilities for which, considering the relatively small production volumes, could advantageously be constructed jointly by CEMA member states. The Czechoslovak people may participate within the framework of these joint production facilities by producing ultra-pure and reactive materials.

An important problem at the present time is the effective introduction of computer technology for use in the comprehensive management of production technologies in all branches of the national economy. The reason for this is a shortage of basic programming systems. There is also a shortage of all types of memories and a number of peripheral devices needed for the assembly of computer systems.

A solution of such problems in a situation which is equal to all CEMA member states requires the integration of production and planning facilities, and the Czechoslovak people can contribute here in both areas.

In the area of the technology of transmission, new and highly effective technological possibilities are becoming available as a result of the mastery of the production and utilization of optical electronics. This is a promising branch of transmission devices, which spare scarce metals, and whose use significantly increases possibilities for the cybernetization of the national economy. Likewise, cybernetization, by ensuring the production and introduction of industrial robots and manipulators, is a basic precondition for and component of an effective solution of the automation of workplaces and entire production systems both in industrial and nonindustrial branches. The use of industrial robots and manipulators is of exceptional significance for machine-building production, where a number of positive effects are becoming apparent.

The development and production of industrial robots and manipulators is proceeding in an uncoordinated manner, with a divided approach in research and development and in provisions for production, and although contractual documents have been signed, we lack production facilities and bases for the production of unified components and junctions, both mechnaical and electronic. The technical level of the types produced is inferior to the peak world level, as is the extent to which they have been introduced. We need to import from the developed capitalist states, at a considerable cost in foreign currency, essential junctions and components.

Czechoslovak interest is motivated primarily by the economic effectiveness of introducing industrial robots and manipulators. In addition, the area of industrial robots and manipulators offers promise as a production and export program which corresponds to the technical and production capabilities of the Czechoslovak engineering industries.

The bases have been created in the CSSR for further planned and gradual development of industrial robots and manipulators and for the robotization of production processes, but the wider introduction of industrial robots and manipulators

and their development, research and production to the full extent necessary cannot be sufficiently effective without the required cooperation within the framework of CEMA member states.

An object of great interest to Czechoslovakia, which is also gradually beginning to interest the other member states as well, is the extensive coordination of the construction of nuclear power plants and the development of nuclear equipment. According to the USSR, which understandably occupies a decisive place in the research and development of this equipment, the CSSR is in second place. Since 1974, we have been building a production basis for nuclear engineering in Plzen, Vitkovice, Olomouc and elsewhere. We have constructed facilities and are now manufacturing reactors, steam generators, volume compensators, main circulation piping, main shutoff fixtures, and other components. We intend to advance in the production of such equipment at a higher technical level as well. We are practically in the middle of preparations for initiating the production of nuclear equipment with a unit capacity of 1,000 MW, which equipment should ensure the construction of nuclear power plants by no later than the year 2000.

This great interest by Czechoslovakia derives from the fact that nuclear energy is for the CSSR the only energy source with the capacity for long-term dynamic development. It is, not only for the present but for the next 50 years, practically the only possibility for ensuring the growth of primary energy sources. Nuclear power plants will by the year 2000 take over a decisive share of the output and production balance of electricity (in 2000 from 57 to 60 percent).

We are considering as part of nuclear energy sources also the use of these sources for supplying heat.

The development of the fuel and energy balance requires that we take into consideration, for all nuclear plants of the CSSR, the consumption of thermal energy for heating and, where appropriate, for technological processes. At present, the limiting distance for supplying heat and hot water is considered to be 50 km, for steam 25 km. Czechoslovak VVER-440 housing blocks are able to consume up to 416 MW of thermal energy, while VVER-1000 blocks can consume up to 1000 MW of thermal energy.

The construction of nuclear district heating plants, for which we have at present, looking 50 years ahead, developed preliminary plans for 14 localities, with a power supply of 200-3000 MW, has not yet been completely worked out from the standpoint of providing for the appropriate equipment.

As in every highest order innovation, the construction of nuclear power plants has given rise to a need for basic innovations in a number of areas of industry (primarily the metallurgy, engineering, electronics and construction industries), with related demands for investment and personnel provision for the necessary reconstructions. Basic innovations, especially in the metallurgy and engineering bases, have been completed in the past, and are underway in some areas at present, but in the future capital investment requirements for engineering will decline significantly.

Also of particular significance for the CSSR is the further expansion of cooperation between CEMA member states and developing countries, especially states with a socialist orientation. We are referring primarily to the Socialist Republic of Vietnam, Cuba, and Mongolia, but also to Afghanistan, Angola, Ethiopia, Yemen, Laos and Mozambique. The aim of this cooperation is primarily to strengthen the government sectors of the economies, to utilize their natural sources and to intensify the training of native personnel. We have rather significant possibilities in this direction. We have already mentioned that at present the development of the Czechoslovak economy is limited mainly by shortages of raw materials and qualified personnel. Both of these problems can to some extent be solved through cooperation. There are enough topics, if our enterprises approach them without bias and with initiative. It is, to be sure, true that it is more convenient to have a factory in the Malesice district of Prague or in the Petrzalec district of Bratislava and to employ personnel with 50-100 year traditions of industry, but thinking like this solves nothing. If world producers thought like this, there would be no production in Singapore, Hongkong, India, the Philippines, etc. This must involve assembly line, technically less demanding production, relatively labor intensive and marketable, and located in the cooperating country. These should also be production facilities which are lacking in the CSSR, such as those for automobiles, transducers, small hydroelectric power plants, pumps, small gasoline engines, tools, etc.

Finally an agreement on coordination, not only of plans but of economic policy as a whole for the period 1986-1990, formed the concluding topic of the 36th session of the council, which, as regards scope, will mean the opening of a completely new stage in its work, a stage of intensive development of all society. It can therefore be said with justification that the CEMA meeting in Budapest means another fundamental step forward in consolidating mutual cooperation. Not only from the viewpoint of specific agreements and documents which were adopted at the meeting, but to an equal degree from the viewpoint of defining and unifying, or at least bringing closer together, opinions, and openly and critically evaluating the situation, its possibilities and mutual responsibilities.

9832
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ZEOLITE IN LIVESTOCK FODDER TO SAVE GRAIN

Bratislava ROLNICKE NOVINY in Slovak 12 Nov 82 p 3

/Article by Dusan Koncek: "Fodder Mix with Additive of Zeolite, a Valuable Mineral"/

> /Text/ In recent years we have had to cover the high consumption of meat in our republic by importing grain and fodder, especially from capitalist states. During the Sixth 5-Year Plan alone we imported almost 8 million tons of grain and in addition 3.6 million tons of concentrated protein fodder. Approximately every fourth kilogram of meat consumed between 1971 and 1980 was produced from imported ingredients. And importing these nowadays is becoming more and more demanding of foreign exchange. Prices on capitalist markets are increasing and such importation has exceeded the limits of our capacity as regards foreign exchange.

Seeking nontraditional sources of feed, in addition to increasing production of traditional ones, is one of the ways that is well established here. We have plenty of unused resources in this area. The preparation of livestock fodder is of basic importance in accelerating the growth of livestock production. In the CEMA countries, for instance, the preparation of fodder from petroleum products is under study in goal-oriented programs. All this, however, means taking from where, on the other hand, it is needed.

However, taking it from wherever it is located and where so far nothing is being done with it, taking it from the bosom of nature without doing any harm, that would really help reduce grain imports and be a considerable contribution toward self-sufficiency.

In 1756, the Swedish mineralogist Cronstedt discovered the zeolite group of minerals, technically known as crystalline hydrous aluminosilicates of alkalis and alkaline earth cations and gave them the Greek name zeolite which, translated, means "boiling stones." These, however, have been well known for decades to the inhabitants of Nizny Hrabovec and Kucin in what is now the district of Vranov. They had early recognized, unknowingly, the properties of this rock, light green to light gray in color. It was put to good use in

their cellars. Everyone who paved his cellar with this stone, obtained from the nearby mountain, could be certain that the vegetables, potatoes or fruit stored in his cellar would keep fresh until late spring. Farm animals also wandered here and they liked the taste of the rocks.

Five years ago members of the Geology Department of Comenius University in Bratislava came to this region and reported on the interesting occurrence of zeolite near the towns of Nizny Hrabovec and Kucin. Up to that time we had not encountered any occurrence of zeolite here, even though zeolite and its mineral components have been used worldwide for decades. Mineralogical examination which followed the interesting findings showed that the chief mineral component of this tufaceous rock is a zeolite mineral called clinoptilolite.

This discovery produced a reaction among geologists and then also among researchers. In fact, there is literature on the use of this rock, not only in agriculture but particularly in it, as used in such countries as the USSR, the United States, Bulgaria, Hungary, Japan and others. It sufficed to look into this literature to see that the uses of zeolite offered interesting possibilities here too.

At first glance this is a logical question: What does Gejza Langer, enterprise director of the Ceramics Works in Kosice, have in common with agronomists? Nowadays this question is irrelevant because agronomists are becoming more aware of this Gejza Langer than they are in his own factories. Agricultural enterprises are turning to him and to the commercial department with requests indicating an interest in zeolite. It was precisely Enterprise Director Gejza Langer who did not hesitate even a moment when it came to starting down quite challenging but very promising paths. And so began his collaboration with geologists and with employees in the Department of Internal Diseases of Ruminants and Hogs at the VSV /College of Veterinary Medicine/ in Kosice. The driving force of this machine was and still is Gejza Langer. With the resources of his plants he went about extracting the first tons of the rock for experimentation and had them ground into the necessary sizes in his plants. And that was not all. Around the mountains of Nizny Hrabovec and Kucin he set in motion a merry-go-round which, to be sure, still does not turn enough, but the results of clinical tests showed he was right. It pays to aim high when something like this case shows up. I think it suffices to say that before long the Slusovice JRD /Unified Agricultural Cooperative/ in the district of Gottwaldov was interested enough to buy a great amount of the rock...And this agricultural enterprise is not used to buying a pig in a poke.

The activity of the enterprise director was great. Doc MVDr Pavol Bartko, CSc, of the VSV in Kosice and Prof MVDr Leopold Vrzgula, CSc. of the Institute of Experimental Veterinary Medicine, undertook, together with their coworkers, to verify the suitability of using zeolite in livestock production. Those first small-scale experiments showed that zeolite added in a ratio of 5 percent to feed mix had no negative effect on the health of the animals. On the contrary, there was an increase in weight and improved conversion of nutrients. The use of zeolite had a favorable effect on dietetic diarrheal symptoms and tests to eliminate odors in large-capacity buildings were also positive.

When Enterprise Director Gejza Langer learned of these results he gave the merry-go-round another whirl. It's a wonder he did not wear out his legs going to offices just to manage to get these results, together with MVDr P. Bartko, CSc, to the world conference which was held in Rochester, in the United States. He succeeded. The two enthusiasts did not go on a junket, rather they wanted not only to give their presentation, but to hear something of interest about zeolite and also to learn something. The results of the small-scale experiments of our researchers aroused well-deserved attention "across the pond." Zeolite has been known in the United States for over 40 years. They do not use it as an admixture to fodder because they have enough grain and the cost of their grain is actually the world market price. But they have experience with the use of zeolite in water management, in purifying waste waters, in filtration, in fishpond management and in trapping gases. In other countries, as for example in Japan, zeolite is proving useful in raising poultry, in plant production, increasing the fertility of the soil and in cultivating fodder crops.

Zeolite is very important to us in that first phase of investigation, in conserving grain. And in this regard, at the conference it was shown that we are a jump ahead of the world, even though so far only in experimental feeding. And we will be working on this use of zeolite for 3 to 4 years.

After the clinical tests, or rather small-scale tests, the researchers started on a more challenging job, to prove their claim about the good and positive properties of zeolite in livestock production through large-scale experiments under production conditions.

These tests are now going on. Some have already been completed and a conclusive report on the results will be published in the spring of next year. Even so it can now be said that zeolite from Nizny Hrabovec and Kucin as an additive to feed mixes is a very useful thing, not only from the point of view of the national economy,

Prof MVDr Leopold Vrzgula, CSc, who is the chief coordinator of the project to research the preparation and verify the suitability of using zeolite in livestock production, says, apropos the tests:

"The results of our observations in clinical tests of adding 5 percent zeolite to feed mixes are very favorable; frankly stated, they exceeded our expectations. Except for the noteworthy weight accretion in the test groups compared with the control groups, we did not ascertain anything substantive that would have a harmful effect on he animals. When we learned that the weight increases in the test animals were greater, we asked ourselves why this was so. The fact is, the researcher must probe deeply, just as in computation: when we add up two figures we have to test for the correct answer. There is no point in burdening the reader with scientific theories, even though they are significant to us, but one can perhaps imagine the process like this. When we give the animals zeolite, where its mineral component clinoptilolite plays a large, determinant part, then the process of digesting food lasts considerably longer. Zootechnicians know how complicated the digestive process is, what all goes on within the animal's

stomach, the kinds of influences there and the like. For lay persons it should be said that clinoptilolite binds the nutrients in the stomach and prevents them from leaving quickly. That 'factory' which the animal's stomach resembles, makes better use of the nutrients, which is later reflected in increased weight and also the quality of the meat. Tests, for example, showed that young cattle had better appetites for feeding. Results with diarrheal problems are noteworthy. The addition of zeolite to the feed mix stopped diarrheal symptoms but, what is more, they did not return as is the case nowadays, where after the use of antibiotics the problem recurs.

"We found similar results in experiments with sheep. Moreover, in the case of sheep it is possible to add zeolite to their bedding to prevent an infectious hoof disease. But this also applies to beef cattle where the addition of zeolite to their bedding makes it drier, eliminating odors."

It can also be said that, on the basis of clinical tests, zeolite is opening the gates to the versatility of its applications. For the time being, however, we have directed our experiments primarily toward livestock production. Known tests up to now under production conditions only confirm that from the national economic point of view the merry-go-round should greatly speed up its revolutions around the uses and application of zeolite.

For example, before adding zeolite to the feed of hogs the control specimens each gained 0.428 kg per day and the experimental ones 0.486 kg. The difference is apparent. There is also economy in the consumption of feed. In the same test, it was 3.68 kg for the control group and 3.61 kg for the test group.

A test with the feeding of 115 bulls over 6 months with the addition of 5 percent zeolite to their fodder mix has also been completed. Weight increases of the control group were 0.828 kg, of the test group 0.853 kg. This is a clear plus with a high economic impact. Another experiment with 1,888 pigs over 6 weeks showed that the weight increase per animal per day was 0.305 kg in the control group and 0.315 in the test group. The control group consumed 2.31 kg of feed, the test group 2.25 kg.

The results of clinical experiments are practically identical with those done under production conditions. Even though all of the production tests are not completed, one thing can be said today: By adding zeolite to the HZ feed mix, better weight increases are obtained, great savings in feed are achieved and the animals' health is improved, with fewer dying. And these are significant factors which indicate that the results of the tests should be put into practice as soon as possible.

Nothing has been said of the fact that other positive factors are also detected here. Adding zeolite to the feed of pigs results in greater weight of the pigs. Certainly positive results are shown also in the use of zeolite in raising poultry. We have already started with these tests, for example, at Salgovik near Presov. The experiences from Japan, where they are already doing this, indicate that by adding zeolite to poultry feed its usefulness was increased up to 20 percent, weight accretions increased, there were fewer deaths and the poultry droppings were denser. The Japanese are also making successful use of zeolite to improve the microclimate in large poultry houses.

Experiments with livestock production speak clearly. Even those orders at the commercial department of the Ceramics Works in Kosice, though it must be said that zeolite is not so much of a miracle that we should rely on it, as is the custom with us. It is, though, a big help in savings of grain. It is literally a pile of bread. We just have to bite into it.

The entire cycle of tests and their official results are to be concluded next spring. Employees of the Geological Survey have everything nicely mapped out, all prepared from those positions of theirs. They can already lay it on the table and say, "So you can begin with the mining, processing and production." Meantime, raw materials for the tests are being extracted in small quantities by the Ceramics Works in Kosice, on their knees, so to speak. Work should be started in a few months when the results of the tests are evaluated. Except that for the time being everything is on the back burner. Research on the processing, verification and application of zeolite is in the plans of departmental research of the Ministry of Agriculture and Food /MPV/ of the SSR. Except that, while the Vrzgula people from the VSV in Kosice, the Geological Survey and the Ceramics Works (they are not in the SSR MPV department) are doing everything to make use as soon as possible of the results and possibilities of zeolite, we find that the Research Institute of Soil Science and Plant Nutrition has not even started with its tests. Meantime, at a recent conference held at the Ceramics Works, we heard that successful use of zeolite in nuclear power plants is showing up. From this point of view, it is clear that the research task in the research institute itself, which is in the SSR MPV department, was not duly appraised and, on the other hand, that it was not supposed to be only the departmental task of the SSR MPV. The procedure whereby a departmental research project becomes one of the statewide research projects is a protracted one. But it need not be so if in the department itself all components discharged their responsibilities in time.

Persons from the Research Institute of Soil Science and Plant Nutrition came to the meeting mentioned earlier without reporting any kind of results and their employee said a few words about the kinds of soils in Slovakia. After all, we know that. What we want to know is how zeolite is being used in plant production. In Bulgaria and in Hungary, they successfully completed testing zeolite tuff in plant production. Likewise, in the USSR and Romania they already have the results and are utilizing the mineral substrata successfully in practice. At the coordination conference mentioned above, the president of the JRD from Slatinske Laze came forward with some initiative. That cooperative farm wants to produce a feed mix with zeolite added. One must appreciate that tests are being run by them, too, and in this cooperative they certainly can figure out what to do with them.

I would like to point out his initiative and his courage to stick with it when something like this is going on. Except that when I think about it as a national economist, then it seems silly to haul zeolite from Vranov to Zvolen and then that fodder mix back to eastern Slovakia. From a Slovakwide point of view, it would be sensible if there were only one central factory for such fodder mixes. But then why couldn't one be somewhere near Vranov?

Finally, going back to that coordination conference, to one impartial participant it seemed that all the skirmishers made a great deal with their elan and enthusiasm over utilization of this valuable mineral. It also appeared, however, that there is too much on their shoulders. There should be some coordination of all components that are taking part in the matter. And since the results of using zeolite in livestock production are quite clear, they should start mining, processing and grinding the "boiling stones." We could benefit from the highly important effects on the national economy, the millions of savings in grain feed and the substantial increases in yields from livestock production. Not to mention where else we might encounter its usefulness. Zeolite really offers an unusual range of applications and it is cheap, coming from nature itself, without any detriment to its "health."

In the next article on the use of zeolite, we will visit an agricultural enterprise where we will encounter the use of zeolite under production conditions as an additive to feed mixes. We will try to ascertain what effect it is having and what kind it may have in the future.

8491
CSO: 2402/15

ORGANIZATION, FUNCTIONS OF ACADEMY CENTRAL OFFICE DEFINED

Budapest AKADEMIAI KOZLONY in Hungarian 27 Sep 82 pp 137-153

[Appendix to Directive No 20/1982 (A.K. 8.) MTA-F of the secretary general of the Hungarian Academy of Sciences, concerning the organizational and operational regulations of the Central Office of the Hungarian Academy of Sciences]

[Organizational and Operational Regulation of the Central Office of the Hungarian Academy of Sciences]

[Text] Chapter I

The Role of the Central Office in the Organization of the Hungarian Academy of Sciences

Paragraph 1

(1) The task of the Central Office is: to perform the decision preparation, planning, organizing, coordinating, implementing and control activities necessary for the operation of the Hungarian Academy of Sciences (hereinafter: academy), and to perform the office work corrected with this.

(2) The Central Office handles the administrative tasks which fall on the academy in directing research nationwide, as well as the tasks related to the direction and control of the academy's institutions; it also cooperates in the organizing and management work needed for the activities of the various bodies.

(3) In the national administrative organization, the Central Office functions as a national administrative organ with nationwide authority.

(4) Supervision of the Central Office is provided by the academy's secretary general by his legal authority as head of the organ with nationwide authority; the directing is accomplished with the cooperation of his deputies and of the office manager appointed by him.

Paragraph 2

(1) The secretary general handles the tasks which fall on the academy in the nationwide direction and coordination of research projects, with the cooperation of the Central Office—and relying on the academy's scientific bodies.

(2) These tasks are as follows:

--taking care of implementing the research or research coordinating activities assigned to the academy by the Council of Ministers, and of preparing proposals, opinions and evaluations related to scientific research;

--participating in developing, modifying and executing the national research plans;

--organizing and directing the main directions and programs in the national research plans and assigned to the academy;

--preparing the academy's position in connection with the proposal and statute drafts submitted by the ministries and organs of nationwide authority for opinion;

--supporting research projects conducted at other than the academy's research facilities--primarily at the universities--which particularly serve the scientific policy goals; promoting the cooperation of the academy's and other research facilities;

--promoting the practical application of research results with the cooperation of the affected ministries and organs of nationwide authority;

--implementing those national assignments of the personnel policy tasks affecting research which have been assigned to the academy, and contributing to the enlistment of researchers in institutions which do not do research as their basic task;

--examining the scientific basis of major national investments and furnishing an opinion about the major investments on this basis;

--national coordination of Hungarian participation in nongovernmental international scientific organizations;

--national coordination of the international scientific connections of the domestic social science research facilities;

--implementing the domestic tasks related to the United Nuclear Research Institute in Dubna;

--handling our country's tasks in the "Interkosmos" space research cooperation, and coordinating domestic space research;

--handling the operation and modernization of the system which provides the research work with professional information;

--handling those national tasks of managing the research instruments which have been assigned to the academy;

--handling the other national administrative, research organization and research directing tasks assigned to the academy by the Council of Ministers.

Paragraph 3

(1) The secretary general handles the implementation of tasks related to the supervision and directing of the academy's institutions, with the cooperation of the Central Office--and relying on the scientific bodies of the academy.

(2) These tasks are as follows:

--taking the initiative in establishing, transforming and closing down the academy's research institutions;

--establishing, transforming and closing down enterprise organizations which belong under the academy's supervision;

--defining the basic functions of research facilities and other institutions which belong under the academy's supervision;

--determining the organizational and operational principles of the academy's institutions;

--analyzing and evaluating the operation of institutions which belong under the academy's supervision;

--issuing normative directions whose authority covers the institutions supervised by the academy;

--occasionally assign some specific research, expertise and opinion-rendering, etc., tasks;

--implementing the initiatives and measures which promote practical application of the scientific results achieved by the academy's research facilities, supporting research efforts and developing new formats of operation;

--aiding and organizing the contacts of the academy's research facilities among each other and with other organizations outside the academy (research facilities and enterprises and institutions interested in research); analyzing the experience of the cooperation;

--directing the publishing of scientific books and magazines in the interest of publicizing the results of scientific research--with the cooperation of corporate organs;

--promoting the utilization of inventions developed in the academy's institutions and implement the academy's invention policy principles;

--analyzing, coordinating, and planning the budgetary, investment, wage and personnel needs of the academy and of the institutions it supervises, distributing the financial means and personnel approved by the Council of Ministers in accordance with research policy goals, and supervise and control the economic operation of the institutions;

--supervising and controlling the personnel work of the institutions supervised by the academy;

--issuing guidelines, directives and normative regulations for the academy's institutions concerning international scientific relationships;

--providing supervision from the legal viewpoint for the scientific associations and companies which belong to the academy;

--handling the reports and complaints of public interest related to the operation of the organs which are supervised by the academy;

--and further, handling all those other activities which are related to the work of supervising and directing, or which the secretary general assigns to it for handling from time to time.

Paragraph 4

Handling the preparatory, organizing and administrative work necessary to implement the tasks of the scientific bodies defined in their bylaws and in special regulations is the task of the Central Office.

Chapter II

Management of the Central Office

Paragraph 5

The Secretary General

(1) Within the framework of the statutes which apply to him, the secretary general directly, or indirectly through his deputies, directs the implementation of the tasks detailed in para 2 and 3 of Chapter I, and of other tasks within his authority, in accordance with the contents of the resolution of the Council of Ministers and with the bylaws in effect at the time.

(2) The secretary general makes the decision or takes the necessary steps in all matters which the statutes expressly refer under the personal authority of the secretary general, or which he takes into his personal jurisdiction.

(3) The secretary general has the personal authority to act especially in the following matters:

--according to the terms of law decree No 6 of 1979 dealing with the academy, in representing the academy as an organ of nationwide authority, in dealing with superior and concordant organs;

--in submitting presentations, proposals and reports to superior and concordant organs;

--in issuing the secretary general's normative directives, and measures aimed at the implementation of higher order statutes and other regulations;

--in issuing orders concerning the establishment, reorganization, and closing down of institutions, enterprises, and service facilities supervised by the Central Office of the academy;

--in the planning and distribution of financial and intellectual resources necessary to operate the academy's institutions;

--in determining the organization and operating rules of the Central Office, and in approving its working plan and control plan;

--in submitting proposals for governmental decorations, and in the granting and revoking of the "For Excellent Work" order and other nongovernmental decorations;

--in determining the personnel policy to be followed in the Central Office and in the institutions it supervises--within the framework of the statutes in effect--and in designating important and confidential jobs;

--in the theoretical guiding of tasks which fall onto the Central Office from the academy's domestic and foreign contacts;

--in providing guiding principles for the academy's information, press and propaganda activities.

Paragraph 6

The Deputy Secretary Generals

(1) The deputy secretary generals independently direct the work of organizational units placed under their supervision by the secretary general and handle all the tasks the secretary general assigns to their spheres of activity.

(2) They make decisions in matters referred to their authority, inform and receive reports from the heads of organizational units they direct, and regularly inform the secretary general about their activity.

(3) Upon case-by-case approval, they represent the academy in domestic and foreign organizations, in connection with their supervisory work in negotiations with the appropriate leaders of ministries and organs of nationwide authority.

(4) With the cooperation of the main departments they supervise, the deputy secretary generals.

--coordinate the development of research concepts;

--follow the work of the research facilities with attention, analyze, provide opinions about and evaluate the activity of the research facilities;

--initiate and support the working relationships among the research facilities and with other institutions.

(5) The deputy secretary generals exercise the rights of employer according to specific regulations.

(6) In order to perform their jobs, the deputy secretary generals may make use of the cooperation of any main department or institution supervised by the academy. Inasmuch as the measures they take may affect the supervisory sphere of authority of another deputy secretary general, they inform the deputy secretary general in question so affected.

(7) If the secretary general is unavailable, the deputy secretary generals also handle the tasks which belong under the personal authority of the secretary general, according to the order of succession designated by him.

(8) If the deputy secretary generals are unavailable for an extended period of time, the secretary general provides aubstitution for them.

Paragraph 7

The Office Manager

(1) The office manager appointed by the secretary general exercises internal office supervision over all organizational units of the Central Office, which means supervision of operation, internal management, and administration.

(2) The office manager takes care of modernizing the technological and organizational conditions of office work, strengthening office and work discipline, rational utilization of the working hours budget, ensuring proper working conditions for the personnel, etc.

(3) The office manager exercises full control over the organizational units placed under his direct control.

(4) The office manager organizes, coordinates, directs and controls the implementation of tasks contained in the resolutions of the secretary general and other management persons in the work plans and in other decisions mandatory for the Central Office.

(5) The office manager represents the Central Office in working relationships which exist with the appropriate heads of national administrative, social, and interest-protection organs.

(6) In those cases when implementation of a higher level statute or effectuation of other measures does not make it necessary for the secretary general to issue normative directions, the office manager--on the basis of authorization from the secretary general--may issue mandatory regulation, directives, circulars, etc., for the Central Office and for the academy's institutions.

(7) The office manager exercises the rights of employer within a sphere of authority defined by special regulations.

Chapter III: General Tasks of Employees of the Central Office

Paragraph 8

Main Department Heads, Their Deputies, and Leading Employees

(1) The main department heads and independent department heads (hereinafter: main department heads) are responsible for directing the work of organizational units placed under their supervision.

(2) Among the general tasks of the main department heads is to

--organize and direct in their specialty areas the planned professional and economical implementation of tasks deriving from the resolutions of higher organs, from the organizational regulation and work plan of the Central Office, and from the resolutions and decisions of the secretary general, his deputies and the office manager, and to supervise this implementation; to

--define the job assignments of workers of the organizational unit they head and provide the necessary working conditions for implementing these tasks; to

--encourage the constant improvement of political, economic and professional knowledge as well as the knowledge of foreign languages for themselves and for their employees.

(3) It is within the sphere of authority of main department heads and their responsibility to:

--maintain contacts with the appropriate leading employees of ministries and organs of nationwide authority appropriate for their areas of operation;

--develop and represent the viewpoint of the organizational unit they head in outside organs which belong to their area of operation and, based on specific authorization, represent the viewpoint of the Central Office;

--maintain contacts with foreign organs in matters corresponding to their area of operation on the basis of authorization granted by the secretary general or his deputies;

--make suggestions for building up and operating the organizational unit they lead;

--make decisions or issue opinions in personnel and disciplinary matters of the organizational unit's workers according to the order of authorities approved by the secretary general;

--according to the rules dealing with exercising the rights of employer, participate in qualifying the unit's workers, make suggestions regarding the pay, bonuses or recognition of the workers, or express an opinion in connection with such initiatives arriving from elsewhere, and within the organizational unit coordinate the times for vacations and authorize vacations.

(4) A separate section contains the special tasks of main department heads according to the characteristics of the individual main departments.

(5) The deputy main department head substitutes for the main department head in his absence, and in harmony with the characteristics of the main department participates in directing the main department on the basis of distribution of work as determined by the main department head, handling the tasks referred to his sphere of authority.

(6) The leading employees of the main departments (chief advisors, advisors) perform organizing, coordinating, supporting, directing, control, etc., work in matters which belong in their area of specialty, independently and on their personal responsibility, based on assignment and authorization by the main department head and in representation of the Central Office.

Paragraph 9

Scientific Secretaries

The scientific secretaries perform their work under the theoretical and professional guidance of the academy's chairman, vice chairmen, or department chairmen, within the framework of the Scientific Corporate Secretariat, under the direct supervision of the secretariat's head.

Paragraph 10

Department Heads and Their Deputies

(1) The department head and independent group leader (hereinafter: department head) is responsible for the operation of the organizational unit under his leadership. According to the orders of the main department head, he organizes, and in his area of specialty, directs the planned, professional and economic implementation of tasks which belong to the unit he supervises, and supervises this implementation.

(2) The deputy department head handles the department head's duties in his absence, and also directs and supervises the work of employees assigned to him, and in addition to this he also handles case-expediting activities.

Paragraph 11

Workers (Case Expediters)

(1) Case expediters handle matters with personal responsibility which belong to their job areas, as well as matters assigned to them by the leaders.

(2) Case expediters must be familiar with their areas of specialty, with the academy's tasks, with the general rules of case handling, the statutes in effect concerning their area of work, the regulations affecting the work of the organizational unit, etc.

(3) Generally only his immediate superior may give orders to a case expediter. If a higher leader gives a direct order to a case expediter, he must afterward inform his immediate superior about this.

(4) Case expediting and assistant workers are required to handle the tasks determined for them by their supervisor.

Chapter IV: Advisory Organs

Paragraph 12

The secretary general and the Central Office operating under his supervision primarily rely on the academy's bodies as advisory, opinion-rendering, and suggestionmaking organs--in accordance with Paragrph 32 of the bylaws--in handling tasks which derive from directing nationwide research, and from supervising the research projects conducted in the academy's institutions.

Paragraph 13

(1) In order to help handle the tasks which fall upon the academy within the framework of directing and coordinating nationwide research, the secretary general operates the Research Policy Council as an opinion-rendering and suggestionmaking organ.

(2) In the interest of promoting the implementation of specific directing tasks, the secretary general may set up professional directing committees and various ad hoc advisory organs as opinion-rendering, suggestionmaking and decision-preparing organs.

(3) The secretary general holds secretary general's conferences in the interest of preparing administrative- and research-organizing decisions which affect the academy or the Central Office as a whole, and also for evaluating the academy's presentations, reports, etc., submitted to the superior organs, as well as in the interest of promoting the organization, systematic review and evaluation of office work.

(4) The deputy secretaries general hold deputy secretary general's conferences as necessary in matters which affect several office divisions.

(5) The office manager holds office manager's conferences for familiarization and discussion of tasks before the organizational units of the Central Office, as well as for evaluation and control of the work done.

(6) The main department heads hold main department conferences to discuss the tasks before the organizational units, and to control the work.

Chapter V: Organization of the Central Office

Paragraph 14

(1) The Central Office is divided into the following main departments:

--main scientific departments:

Main Department for Natural Sciences
Main Department for Social Sciences

--functional main departments:

Main Department of Personnel
Main Department of Research Organization
Main Department for International Relationships
Main Financial Department
Main Administrative and Legal Department

(2) Concerning the place they occupy in the organizational order, the following organizational units are judged on the same level as the office's main departments:

Interkosmos Council Secretariat
Scientific Corporate Secretariat
Secretariat of the Scientific Qualification Commission

(3) In the absence of regulations to the contrary, in applying the current regulation the organizational units listed in Section (2) must be considered as main departments of the Central Office.

(4) The secretary general may set up permanent or temporary offices, secretariats, services, etc. for handling unique (branch, coordinative, etc.) tasks. The place of these in the organization is determined at the time they are established.

Chapter VI: Operational Rules of the Central Office

Paragraph 15

The Basic Principle of Case Handling

(1) Tasks must be handled creatively, with initiative, independently, quickly and accurately, in a well-considered and responsible manner.

(2) Those procedures must be applied in case handling which increase the independence and responsibility of institutions and rationally decrease administrative activity.

(3) Primarily those regulatory, organizational and other tools and methods suitable for orientation must be used for the necessary influencing of the main processes of research activity which shape the interest relationships;

support must be given to the research undertakings which promise valuable new results; to the outstanding basic research projects; while make-do activity valueless from the scientific and practical viewpoints must be cut back.

(4) During the course of case handling, one must proceed in cooperation with the appropriate corporate organs of the academy in all matters whose importance requires this.

(5) The main departments are official organs on the same order and are obligated to perform their activities in close cooperation with each other; during the course of solving some concrete problems this being on the same order may be temporarily replaced by dependence, super- or subordination.

(6) All workers must be familiar with and apply the regulations concerning case handling.

Paragraph 16

General Rules of Case Handling

(1) Within the sphere of official tasks, cases must be handled on their merit, observing the statutes which concern them, the superior's guidance, and the designated deadline. The facts and conditions needed to make the decision on its merits, as well as the expected consequences of the decision, must be clarified in all cases.

(2) The general deadline for handling a case is 8 days, calculated from the day the case handler receives the document. Governed by the nature of the case, the appropriate leader may specify a shorter or longer case-handling deadline than this. If the deadline is established by statute, the statutory regulation must be followed.

(3) Work must be organized in organizational units in such a way that the person responsible for handling each case, or for failing to handle it, should be identifiable.

(4) If the history of the case handled cannot be established from the document itself, a written summary of it must be prepared and attached to the document.

(5) Any agreements reached within the framework of direct working relationships concerning the handling of a case on its merits, if no record or notes of it were made, must be reduced to writing according to the contents of the previous section.

(6) If the case was handled on the basis of a supervisory directive with which the case handler or the person initialing it does not agree, the opposing opinion must be recorded on the document, specifying the reasons for it.

(7) Workers of the Central Office are obligated to keep national secrets and service secrets they may have learned during the course of handling a case. Documents containing a national or service secret may be taken or send abroad according to specific regulations concerning this.

(8) Case expediting and case handling must be performed according to the regulations of the document-handling regulations.

(9) If, on the basis of this regulation, which organizational unit has the authority to handle a certain case is not clear, the office manager will specify the organizational unit responsible for handling the case.

Paragraph 17

Cooperation Among Main Departments

(1) The main departments perform their activities in close cooperation with each other. This cooperation must be initiated primarily by the main department responsible for implementing the given task. In matters which belong within the sphere of tasks of certain main departments but also affect the spheres of tasks of other main departments, one must proceed by involving the other main departments. In contested questions which occur during the course of this procedure, an attempt must be made to develop a common standpoint by way of coordination. If this leads to no result, the contested issue must be submitted to the office manager who will make the decision under his own authority, or the matter must be prepared for the secretary general or--depending on the division of tasks--for the appropriate deputy secretary general for decisionmaking.

(2) [sic] Scientific departmental secretariates operating within the framework of the Scientific Corporate Secretariat maintain direct contact with the main departments in matters which belong within their sphere of tasks.

Paragraph 18

Cooperation with Corporate Organs

(1) The Academy Coordinating Conference handles coordination of the corporate and professional administrative work conducted in the academy's area of activity.

(2) The main departments of the scientific branches systematically cooperate with the scientific departments corresponding to their professional areas.

(3) The heads of main departments of the scientific branches pay regular visits to the department chairmen and conduct discussions about the most important research management and other timely tasks and about implementation experience.

(4) The leading workers of the main department of the scientific branches in question (corresponding to their professional areas) participate in departmental meetings and provide information there when requested to do so about the main department's activities, about measures which have been taken or are planned; they use the opinions heard at the departmental meetings in their work.

(5) The leaders of main departments of the scientific branches ensure that the departments be able to analyze and evaluate the work of the academy's research facilities continuously and in a planned manner.

(6) The heads of main departments of the scientific branches see to it that the scientific departments are given the opportunity to state their opinions and make suggestions before all research policy decisions of major significance--affecting their professional areas--are made; the departments are kept informed about the use of these opinions and suggestions.

(7) During the course of performing their activities, the functional main departments maintain systematic contact with the scientific departments.

(8) Heads of the main departments of the scientific branches systematically invite the scientific secretaries of the affected departments to the working conferences of the main departments of the scientific branches.

Paragraph 19

Maintaining Contact with Organs Outside the Academy

(1) Organizational units are authorized to proceed to maintain official contact with outside organs in matters within their authority or referred to their authority on the basis of specific assignment. During the course of such contacts, in matters which also affect the sphere of tasks of other organizational units, they involve and inform the other organizational units. The head of any organizational unit may proceed--even without specific coordination--in a preparatory or information-gathering manner in matters within his sphere of tasks even if the final decisionmaking belongs within the sphere of tasks of another organizational unit. In such cases, it is mandatory to immediately inform the appropriate organizational unit to which the task belongs. Negotiation on the merits with outside organs may begin--if it also affects the authority of another organizational unit--only if the office manager has completed the coordination concerning the basic questions, or if a concrete directive has been issued by the academy's leadership (secretary general, deputy secretaries general) for the viewpoint to be represented.

(2) Working relationships with the ministries and with the appropriate main departments of organs of nationwide authority are maintained by the appropriate main departments in matters which belong within their spheres of tasks.

(3) In matters of codification, the Administrative and Legal Main Department of the Central Office maintains contact with the Legal and Administrative

Main Department of the Secretariat of the Council of Ministers, with the Secretariat of the Scientific Policy Commission of the Council of Ministers, and with the legal organizations (secretariats) of the ministries and organs of nationwide authority.

(4) The Administrative and Legal Main Department maintains contact with the Information Office of the Council of Ministers and with the Hungarian Telegraph Office [MTI]. The contents of releases or information to be given to the press must first be given by the heads of main departments to the Administrative and Legal Main Department. The authority for publication is granted by the appropriate deputy secretary general and, in matters affecting the academy as a whole, by the secretary general.

(5) In matters of economic mobilization, civil defense and fire prevention, the Administrative and Legal Main Department maintains contact with the Ministry of Defense or with the Ministry of Interior, respectively.

(6) In procedures before the courts, the Central Office is represented by the Administrative and Legal Main Department.

(7) In matters related to laying down the scientific foundations for national economic planning, long- and medium-range planning of research, research management, the statistical data service and information system, and invention activity, the Main Department of Research Planning maintains contact with the National Planning Office, the Secretariat of the Scientific Policy Commission, with the National Technical Development Committee [OMFB], with the Central Statistical Office [KSH], and with the National Office for Inventions [OTH], respectively.

(8) In financial, budgetary, and investment questions the Financial Main Department maintains contact with the National Planning Office, the Ministry of Finance, and other appropriate organs.

(9) The secretary general appoints the appropriate workers in certain cases and gives them the necessary authorizations to represent the academy in governmental commissions, program councils, interportfolio commissions, etc.

(10) The Interkosmos Council Secretariat maintains contact with the appropriate departments of ministries and organs of nationwide authority in questions relating to space research.

(11) The Financial Main Department maintains contact with the appropriate national organ in labor matters.

(12) The Main Department of Personnel maintains contact with the Main Department of Personnel of the Secretariat of the Council of Ministers and with the Ministry of Interior in personnel matters regulated by separate directives.

(13) The Main Department for International Relationships maintains contact with the appropriate departments of the Foreign Ministry, Ministry of

Interior, Secretariat of the Scientific Policy Commission, Secretariat of the Commission for International Economic Relationships, as well as the other organs of nationwide authority affected by the international scientific cooperation.

(14) A separate paragraph defines the rights and obligations of the main departments of the scientific branches in maintaining these contacts.

Paragraph 20

Contact with Foreign Organs

(1) Contact with foreign organs is maintained primarily by the Main Department for International Relationships. The other main departments contact foreign organs only in matters referred to their authority and in a manner regulated by separate directives.

(2) The main departments may receive foreign guests and conduct official discussions with them only after coordinating it with the Main Department for International Relationships and in a manner regulated by separate directives.

(3) Unless statues regulate it otherwise, the approval of the appropriate deputy secretary general is needed for giving any kind of official document to foreigners.

Paragraph 21

Cooperation with Trade Union Organs

(1) The office manager represents the academy's Central Office before the appropriate branch trade union organs.

(2) The office's leaders are required to cooperate according to the statutes in effect with the appropriate official trade union organs in matters affecting the work relationship, working and living conditions of the workers.

Paragraph 22

The Right to Release Documents and Authorize Funds

(1) The secretary general has the right to release the documents of all matters in which he acts on his personal authority, or which he takes under his personal authority.

(2) The deputy secretaries general and the office manager have the right to release the documents concerning the handling of matters referred to their authority.

(3) The main department heads, their deputies, and leading workers, as well as scientific secretaries, exercise the right of releasing documents in all those matters under their authority in which the right of release is not reserved for higher level leaders.

(4) Department heads, their deputies, group leaders and case handlers have the right to release documents in those cases under their authority for which they have received authorization from their superiors.

(5) Heads of main departments are required to determine the sphere of the right of their deputies, leading workers, or department heads, group leaders and case handlers to release documents, and the conditions for exercising this right.

(6) The person releasing the document is responsible for the content and legality of the documents, along with maintaining the responsibility of the case handler who prepared the case. If a unified position of the Central Office has not been reached in connection with the document, the person preparing the document is responsible for presenting the various opinions without prejudice. Forwarding a document released without authorization is prohibited.

(7) A document released by an authorized person must be stamped with the circular stamp and forwarded to the addressee--according to the regulations of the document handling regulations.

(8) The office manager determines the utilization plan of the financial (budgetary, investment, etc.) means made available to the Central Office for handling its tasks, subject to the secretary general's approval.

In addition to the academy's leadership, the office manager and those workers who are so authorized by the office manager, have the right to authorize funds from the financial means, within the framework specified in the plan. The authorization can be implemented only after it is countersigned by the head of the Economic Department.

Paragraph 23

Preparation of Presentations, Reports, and Normative Directives

(1) The professional draft of presentations and reports prepared for the higher organs (Presidential Council, Council of Ministers and their commissions) on the basis of an approved working plan of the academy or of a special resolution, must be prepared by the most appropriate main department--in cooperation with the other main departments--according to its subject matter, as assigned by the secretary general or his deputies, or in some cases by the office manager. The main department must rely on the professional opinion of the scientific departments, research facilities and other institutions in establishing the foundation for the professional draft. Attention must be given by the main department responsible for the preparation to earlier resolutions, analyses, studies, etc., relating to the matter. Preparation of the presentation or report must be done according to the methodological guide published separately; the resolution proposal must be worded concretely, designating the responsible persons and deadlines.

(2) The responsible main department, after review within the Central Office, sends the professional draft of the presentation or report to the Main Administrative and Legal Department by the specified deadline.

(3) In case of a difference of opinions within the Central Office, the procedure concerning the resolution of contested matters (Para 17, Sec (1)) must be followed.

(4) The Administrative and Legal Main Department examines the draft of the presentation or report from the legal, legitimate and structural viewpoints, then on the basis of authorization by the appropriate deputy secretary general or, in matters of outstanding importance, by the secretary general submits the draft to outside organs for their opinions. The draft of the presentation or report must be submitted for opinions with such timing that at least 15 days remain available for developing the ministerial (main authority's) position.

(5) If the outside organs make an observation unacceptable within their authority in connection with the draft, coordinative negotiation must be proposed. Generally the head of the main department preparing the presentation or report is responsible for the coordinative negotiation, but in case of a separate decision the office manager or the appropriate deputy secretary general has the responsibility. Organization of the coordinative negotiation is the responsibility of the Administrative and Legal Main Department. If the ministerial opposing opinion remains, it must be so noted in the presentation together with the reasons for it, along with the academy's position on the subject.

(6) If the presentation, report, etc. cannot be submitted to the superior organ by the specified deadline, the appropriate main department head by subject is required to make a proposal to extend the deadline or cancel the submission obligation. The deputy secretary general exercising supervision submits the proposal, with the proper justification, to the secretary general, who in turn requests the necessary modification from the superior organ directly or through his appropriate representative.

(7) The rules for preparing presentations and reports for the higher organs must also be used as applicable for the preparation, coordination and final development of the secretary general's normative directives applying to the academy and its institutions, with the supplementary specification that the directive proposal must also be coordinated with the appropriate heads of the most affected institutions and facilities.

The head of the Administrative and Legal Main Department takes care of publishing the secretary general's normative directives in the AKADEMIAI KOZLONY.

(8) The issuing main department must coordinate drafts of guide principles, theoretical positions and publications with the Administrative and Legal Main Department and with the other interested main departments. Publication is authorized by the office manager or, in case of a separate decision, by the appropriate deputy secretary general.

Paragraph 24

Rendering Opinions on Presentations and Statutes

(1) Within the framework of working relationships, the head of the affected main department, the office manager in the name of the Central Office, or the head of the Administrative and Legal Main Department may give opinions of a nonobligatory character for the preliminary drafts of presentations and statutes submitted by outside organs. For drafts submitted for official circulation, the secretary general or his appropriate deputy may give agreeing, modifying or opposing opinions.

(2) The head of the Administrative and Legal Main Department organizes and summarizes the work of rendering opinions on drafts of presentations and statutes received from other organs (ministries and organs of nationwide authority), during the course of which, he takes care that the Central Office furnishes the answer by the deadline--according to the work schedule of the higher organs. He designates--on the basis of guidance by the secretary general or deputy secretary general, if necessary--those organizational units which must give opinions on the draft. The affected main departments which render such opinions are required to develop their opinions by involving the experts of the research facilities and other institutions, and in more important matters the corporate organs of the academy, and are required to submit it, together with the supporting documents, to the Administrative and Legal Main Department by the deadline. The opinion

--must make agreeing or rejecting, or modifying observations, keeping in mind the interests of society and science, and the position must be justified;

--must take a position as to whether the tasks possibly affecting the academy as included in the presentation and in its resolution proposal really belong within the academy's authority, and if so, then do the conditions necessary for implementing it exist or can they be created; and, are there any other tasks which the academy would have to undertake in addition to those proposed;

--must indicate if measures have already been taken in the past in the interest of implementing the tasks which affect the academy and are projected in the presentation, together with a brief description of these;

--must extend topic coverage to the tasks and obligations of other organs if in connection with them significant observations of theoretical significance occur.

(3) Coordination of the differing internal opinions is handled by the appropriate deputy secretary general at the coordinating conference organized by the Administrative and Legal Main Department. The deputy secretary general submits the position developed at the coordinating conference to the secretary general for his approval.

(4) Based on the approved position, the head of the Administrative and Legal Main Department prepares the academy's position to be signed, for the secretary general or his appropriate deputy, by the deadline, and then forwards it to the head of the outside organ. He sends copies of the submitted opinion to the interested subdivisions of the Central Office.

(5) In matters in which the outside organs approach the scientific bodies for advice or opinion, the Scientific Corporate Secretariat prepares the reply drafts of the academy's president, or of the appropriate scientific bodies--with the cooperation of the Administrative and Legal Main Department, if necessary.

Paragraph 25

Keeping Records of Statutes, Resolutions, and Directives, and Control of Their Implementation

(1) Keeping central records of the statutes and resolutions is the task of the Administrative and Legal Main Department. The Administrative and Legal Main Department is required to keep records of the resolutions of higher organs, statutes, the secretary general's directives, and positions taken by the secretary general's conference in an easily reviewable system. This documentation must be made available to all interested workers of the Central Office--according to the specifications of the document-handling regulations.

(2) After the resolutions (statutes, directives) are published, the Administrative and Legal Main Department is required to immediately determine what tasks fall upon the Central Office as a result of them. Based on a suggestion made by the head of the Administrative and Legal Main Department, usually the office manager will designate the organizational unit responsible for implementing it, and notifies its head about the task to be performed, and also informs him of the deadlines for implementation and reporting. In particularly important cases, the office manager requests the decision of the appropriate [deputy secretary general], or, upon his suggestion, the decision of the secretary general, for such designation. The applicable part of the statute (resolution) must be attached to the notice of designation, or information must be furnished as to where the regulation containing the task was published. The notice must also provide information about which persons have received the resolution at the academy. If there are several responsible parties, in the absence of specific designation, the person named in the first place must be considered the responsible party.

(3) If the statute (resolution) serves only as information, the Main Administrative and Legal Department sends it out to the interested parties as such.

(4) The head of the designated organizational unit is responsible for implementing the task contained in the statute (resolution, position, etc.). The office manager continuously monitors the work of the organizational unit related to implementation.

(5) The organizational units are required to send a written report each quarter about implementation of the tasks, to the Administrative and Legal Main Department. The Administrative and Legal Main Department keeps itself continuously informed about the implementation of directives, resolutions, and positions, and prepares a quarterly summary report about this. In case of falling short, it so informs the office manager, the appropriate deputy secretary general, and in all cases the secretary general, too, immediately.

(6) If it is justified to request dispensation from carrying out certain tasks or ask for more time for this, the head of the responsible department is required to take the initiative for it prior to expiration of the deadline.

(7) The Administrative and Legal Main Department keeps record of and guards

--the original publications of the secretary general's directives, and of the publications and theoretical positions developed by the main departments;

--the original copies of agreements and framework contracts related to directing and controlling the implementation of national research and development programs which legally bind the academy;

--contracts, agreements, etc., made by the secretary general and his deputies with the heads of domestic organs;

--original copies of agreements, records, reminders, official trip reports dealing with the academy's international cooperative agreements.

Paragraph 26

Work Plans

(1) The next main tasks of the Central Office must be defined in work plans. The work plan is prepared for a 6-month time period.

(2) The basis for the work plan is formed by the work plans and other resolutions of the higher organs, the tasks specified by the leading organs and leaders of the academy, and the proposals and resolutions of the academy's corporate organs concerning their own tasks.

(3) The proposal for the work plan is prepared by the head of the Administrative and Legal Main Department--with the cooperation of the other main departments and of the Scientific Corporate Secretariat--and submitted to the secretary general's conference. The work plan is approved by the secretary general.

(4) If the work plan designates several people responsible for the implementation of some task, the leader who has the overall responsibility for its implementation must be separately designated. His responsibility is the overall organization and coordination of the entire task, ensuring fullness of implementation and observation of the deadline.

(5) The head of the Administrative and Legal Main Department keeps informed in the manner specified in Para 25, Sec (5) and prepares a report about the implementation of the Central Office's work plan covering the entire office.

(6) Based on the Central Office's work plan the main departments prepare 6-month work plans which are approved by the secretary general, the deputy secretary general supervising the main department, or the office manager.

Chapter VII

The Circle of Tasks of Main Departments

Paragraph 27

Tasks of the Main Department of Natural Sciences

(1) The main task of the Main Department of Natural Sciences is to contribute to increasing the success of domestic and especially the academy's research in the natural (technical, agricultural, and medical) sciences, improve its quality standards, and increase its social usefulness by performing organizing, coordinating, support, analytical, control, etc. activities.

(2) In the interest of establishing the long- and medium-range research concepts the main department

--prepares studies and analyzes in cooperation with the academy's corporate organs, research facilities and the experts of other institutions about the way scientific growth is expected to develop, and about its social and economic effects;

--regularly reviews and analyzes the foreign initiatives, research-policy decisions and economic-policy actions affecting its professional areas;

--takes care of publishing these analyses from time to time.

(3) The main department aids and supports in its professional areas the contacts between the academy's research facilities and the enterprises, and promotes the development of various associative and enterpreneurial formats to serve the practical utilization of research results.

(4) The main department in its professional areas follows with attention and regularly analyzes the domestic situation of the more significant basic research projects and initiates measures in the interest of support for basic research projects important from the viewpoint of the future.

(5) It is the job of the main department to regularly review the implementation of the nationally emphasized research tasks (programs) in its specialty areas which are assigned to the responsibility of the academy's secretary general, and to take the initiative for the necessary indications and measures.

(6) Through its working relationships, the main department keeps systematically informed about the content and situation of implementation of those nationally emphasized research tasks (programs, main directions) in its specialty areas, for which, even though other ministries or organs of nationwide authority are responsible, but in whose implementation the academy's research facilities are also participating.

(7) It is the task of the main department to coordinate the work which lays down the foundations for starting the academy's (portfolio level) programs, main directions, etc. in its speciality areas, and to follow and supervise the implementation of the approved programs and main directions.

At the same time, the main department must also have [the right of] review of the portfolio-level research tasks affecting the specialty areas of other ministries and organs of nationwide authority.

(8) Based on the advice of corporate organs, the main department, according to the guiding principles defined by the secretary general

--prepares the announcement of competitions for research grants;

--renders opinions on the submitted applications and submits proposals for decisionmaking on whether to accept or reject them;

--together with the Financial Main Department, negotiates contracts at the expense of the Central Research Fund, for the accepted applications with the organizations which own the right to the subject;

--supervises and evaluates the implementation of tasks undertaken in the contracts.

(9) It is the task of the main department to cooperate in examining the scientific foundations of major national investments (reconstruction projects), and to submit opinions to the secretary general.

(10) The tasks of the Main Department of Natural Sciences in implementing the supervision of the academy's research facilities, are:

--in a manner regulated by special directives, handles the preparation of medium-range research plans of the academy's research facilities (institutions and the supported university research groups), and organizes a reasonable reporting procedure;

--together with the other affected main departments, cooperates in developing the plans for modernizing the research base, and in preparing proposals for establishing new, or closing down research facilities;

--cooperates with the functional main departments (primarily with the financial, personnel, research planning, and international contacts main departments) in analyzing and evaluating the economic, personnel, planning,

and foreign relations work of the institutions connected with research activity; and in examining the justifications for major research expenditures (investments), and the extent of utilization of certain expensive equipment (machinery, instruments, computers, accelerators, etc.);

--forms a position in connection with the proposals of the functional main departments affecting research facilities (institutions and supported research locations), and also initiates, cooperates with, renders opinions on and, in certain matters, makes the decision about the system of conditions necessary to fulfill the research plans (budget, employment, investment, international and domestic scientific and science-production cooperation, etc.);

--continuously keeps informed about the more significant research activities conducted at research facilities and takes care of supporting the initiatives which increase the level of success; also cooperates in eliminating factors which hinder the work;

--involves the leading experts of research facilities in developing the presentations to be prepared by the academy, and in evaluating the proposals prepared by other organs and sent to the academy for opinion;

--organizes the exchange of ideas about scientific-policy proposals in the development phase and regularly informs the directors of research facilities with the cooperation of its leading workers about the most important scientific-policy decisions;

--develops working relationships with the social organs of the research facilities and with their supervisory organs, and follows with attention the cooperation of the national administration with the social organs of the institutions.

(11) The Main Department of Natural Sciences maintains regular contact with the research and development organizations of the ministries and organs of nationwide authority which supervise activities conducted in its areas of specialty, and with the appropriate organizational units of the National Technical Development Commission.

Paragraph 28

Tasks of the Main Department of Social Sciences

(1) The main task of the Main Department of Social Sciences is to contribute to increasing the level of success of domestic, and especially the academy's, research in the social sciences, increase the standards of its quality and its social usefulness, by performing organizing, coordinating, supporting, analyzing, supervisory, etc. activities.

(2) In this connection, it helps implement the coordinative tasks related to the planning, supervising the execution of the plans, and comparing the socioeconomic results, in close cooperation with the other main departments, particularly with the Main Department of Research Planning.

(3) Cooperates with the scientific and scientific policy making organizations of the ministries and organs of nationwide authority which supervise activities conducted in its speciality areas, and with the party institutions and regional party organs which do social science research.

(4) In the interest of laying down the foundations for research tasks to be announced

--in cooperation with the academy's corporate organs and research facilities--initiates in its speciality areas the preparation of studies (prognoses) to show the expected development of scientific and technological growth, and its social, economic, and political effects.

(5) Assists and supports the multilateral relationships between the academy's research facilities and the universities, public collections and party institutions operating in its speciality areas, promotes the development of various formats of association which serve the practical utilization of research results, and the organized cooperation between institutions of the academy and of the universities.

(6) Follows with attention the situation of the more significant research projects which directly or indirectly serve the long-range needs of its speciality areas in the academy's research facilities, and initiates measures in the interest of appropriate support for basic research projects which are important from the viewpoint of the future.

(7) Regularly reviews and analyzes the foreign initiatives, research-policy decisions and economic-policy actions which affect its speciality areas, and takes care of periodically publishing these analyses.

(8) Helps improve the (bi- and multilateral) social scientific relationships developed with the socialist countries, cooperates in solving the contentual tasks of the conference of the Hungarian-Soviet Social Scientific Cooperation Commission and the social science vice presidents of the socialist academies.

(9) With respect to guidance of the emphasized research tasks and research competition announcements, as well as of the institutions, the Main Department of Social Sciences handles the tasks contained in Paragraph 27.

Paragraph 29

Tasks and Operation of the Main Department of Personnel

(1) The primary task of the Main Department of Personnel is general supervision of the personnel work performed at the academy and in its institutions, on the basis of direct guidance by the secretary general. By supervising the personnel activity of the academy's institutions and of the Central Office--relying on the cooperation of the other main departments--it must ensure uniform implementation of the cadre-policy principles, and through its comprehensive analyses keep the secretary general informed of the most important data characterizing the academy's personnel inventory.

(2) The main department's special tasks are to:

--prepare the secretary general's orders in personnel matters which affect the academy as a whole, personnel development and replacement plans, submitting these for approval, and organizing their implementation, and preparation of reports to the secretary general about experience gained during the course of implementing the measures;

--prepare proposals for appointment, assignment, relief, transfer, decoration, discipline and reward within the secretary general's sphere of authority--or in case of delegated authorities, of the deputy secretaries general, the office manager, and the main department heads--submission of these to the appropriate leaders according to the order of spheres of authority for decisionmaking, and handling the other necessary tasks prior to the decisionmaking (announcement of competitions, rendering opinions on them, and handling the necessary coordination, etc.);

--prepare theoretical and methodological guides for personal qualification of those workers employed by the academy who are required to be qualified, supervising and controlling the qualifying activity;

--participate in the personnel qualification of workers within the appointment authority of the secretary general--and in case of delegated authority, of the deputy secretaries general, the office manager, and of the main department heads--and of the Central Office, who must be qualified, safekeeping the qualifications and keeping record of them;

--keep record of the academy's regular and corresponding members, doctors of sciences, and of the workers of the academy's institutions and research facilities who are in the secretary general's (deputy secretaries general, office manager's) sphere of appointment authority, as well as of the workers of the Central Office;

--take care of implementing the tasks of the branches related to the advance training of leaders and researchers; initiating the further training of leaders and researchers and of their reporting to training seminars, with the cooperation of the leaders of the academy's institutions and with their participation in organizing advanced training for the academy's leaders;

--render opinions on proposals concerning official trips abroad by workers of the Central Office under the rank of main department head;

--prepare proposals for using the academy's educator scholarship funds in cooperation with the main departments of the scientific branch;

--render opinions on proposals concerning titled university professorships and lecturerships involving the academy's workers;

--initiate the necessary procedures in case of a crime or disciplinary offense;

--obtain the data necessary for appointments into important and confidential work assignments and requesting approval from the proper organs;

--keep record of the workers of the Central Office, and of other research facilities as necessary, who have military obligations, and handle the matters of obtaining postponements of military service;

--handle the tasks of preparation for decisions concerning the State Prize and the Kossuth Prize, the Academy's Prize, and of electing to membership.

Paragraph 30

Tasks of the Main Department of Research Planning

(1) The primary task of the main department is to prepare decisions, conduct coordinating activity, and provide information in handling tasks falling upon the Central Office in connection with laying down the scientific foundations for the national economic plans, long- and medium-range planning of research, implementation and control of the plans, development of the research network, and research management and organization, as well as maintaining contact within its authority with the affected ministries and organs of nationwide authority. The main department handles these tasks in cooperation with the other main departments and in the manner regulated by Para 17.

(2) It is the task of the main department to prepare positions, guiding principles, and decisions in connection with:

--setting down the scientific foundations for the long- and medium-range national economic plan;

--relaying the mutual effects between national economic planning and research planning;

--developing the long- and medium-range national research plans, coordinating and supervising their implementation;

--developing the general principles and methods of the research plans of the academy and its institutions, supervising their implementation, and ensuring harmony between financial and investment plans.

(3) In addition, the tasks of the main department are to develop decisions, positions and recommendations to be taken by the academy's leadership to serve:

--modernization of the national and the academy's research base, developing its general principles and methods and its long- and medium-range development plans;

--further development of the methods of research management and organization, and of financing;

--the objective evaluation of research activity, increasing the efficiency of research, promote the socioeconomic utilization of research results; and

--the development and efficient operation of an information system related to the research projects and their management.

(4) In connection with the tasks detailed in secs (2) and (3), it is the duty of the main department to initiate, prepare, or have prepared, and render opinions about analyses, prognoses, concepts, presentations, guiding principles and action plans, and further, the organization and internal and external coordination of activities related to this, as well as maintaining contacts at the main departmental level.

(5) It is the task of the main department to:

--coordinate the rendering of opinions about major investments, develop the academy's opinion, reduce it to writing and ensure representation at possible coordinating conferences;

--follow with attention and analyze the international experiences of scientific and technological political and especially research management and research organization, and to develop proposals for the domestic utilization of such experience;

--handle the tasks which fall onto the academy in connection with the performance of administrative statistical activity;

--handle the direct professional supervision of the Patent Group operating within the framework of the Research Supply Service.

Paragraph 31

Tasks of the Main Department for International Contacts

(1) The Main Department for International Contacts performs preparatory, coordinating, organizing and implementing activities related to establishing, improving and operating international scientific relationships which serve the academy's goals.

(2) The main department's tasks are in general to:

--study the role of the academy's international scientific relationships and fit it into the country's foreign-policy and foreign-trade activities;

--analyze the social, economic and cultural usefulness of the academy's international scientific relationships, and examine the contributions expected to increase the level of success of scientific research;

--develop short- and medium-range strategic ideas and proposals for designating the focal points of cooperation;

--prepare analyses and information on the basis of continuously following international scientific relationships with attention;

--handle the statistical reporting obligation connected with international scientific relationships.

(3) The main department's special tasks are to:

--prepare the academy's international cooperative agreements according to guidance from the secretary general and in cooperation with the main departments of the scientific branch, or from the supervising deputy secretary general, help in their implementation and initiate further developments;

--according to special regulations, to manage economically the budgetary funds serving to foster the academy's international relationships, and taking care that it is used in a planned manner and in the way it was intended;

--maintain contact with the foreign academies and with the corresponding organs of the institutions which direct science;

--handle the official contacts (travel, reception, negotiations, etc.) of the academy's leadership (chairman, secretary general, vice chairman, deputy secretaries general) in the order corresponding to the regulations and under the necessary protocol conditions;

--prepare, coordinate and implement travel into and out of the country connected with the academy's international relationships;

--prepare the plans for scientific events to be organized within the academy's framework, submitting them to the secretary general for approval, and organizing the plan's implementation;

--prepare and conduct the academy's centrally organized international scientific events;

--handle the matters of international organizations which belong within the academy's circle of authority;

--in multilateral cooperative projects set up among the socialist academies, handle the tasks deriving from the academy's participation in cooperation with the appropriate main departments of the scientific branch;

--handle the tasks which fall upon the academy from the scientific cooperation conducted within the framework of CEMA, and from the bilateral imtergovernmental scientific-technological agreements, with the cooperation of the main departments of the scientific branch;

--coordinate and organize nationwide those international scientific cooperative projects which affect institutions outside the academy, and use the monetary funds available for this purpose according to the approved plan;

--organize recordkeeping and use of foreign trip reports with the cooperation of the main departments of the scientific branch;

--supervise the international relationships of institutions supervised by the academy;

--supervise the international relationships of the academy's scientific associations and societies;

--handle the preparatory and coordinative activity connected with the election of the academy's honorary members, and with the election of Hungarian scientists to honorary memberships of foreign academies, on the basis of guidance from the academy's appropriate leader;

--handle the organizing work connected with bilateral joint commissions and magazines;

--make proposals to the secretary general with the cooperation of the main departments of the scientific branch for official trips abroad by heads of the academy's institutions, and preparation and implementation of the authorized trips.

Paragraph 32

Tasks of the Financial Main Department

(1) The primary task of the Financial Main Department is to plan the financial and manpower needs of the academy's research in harmony with the scientific goals and with the cooperation of all interested main departments, and to promote the effective utilization of the resources made available on the basis of the resolution of the Council of Ministers by assisting in the regulation, coordination, organization, regrouping, control, etc. built on interest relationships.

In this connection, among other things it

--also performs wage management, manpower management, manpower protection, accounting, control, and other duties referred to its authority;

--supervises these types of activities of the institutions and also performs general supervision of the academy's enterprises, and economic supervision of service organs and of the academy's centers in the regional districts;

--initiates and supports the research undertakings of the academy's institutions which provide economic results;

--cooperates in the development of various new and flexible formats of activity;

--promotes the national economic and institutional success of contractual research activity.

(2) Its special tasks are to

--prepare the academy's investment plans in harmony with research and development plans and submit them for the secretary general's approval; to carry out the plan approved by a higher organ; to organize this and handle

the top-level authority's tasks in connection with this; technological and economic examination of the preparation of investments listed under the central decisionmaking authority, plan and ensure the financial conditions of, and also organize and supervise the implementation of, investments;

--perform the measures related to the implementation of higher level orders and regulations connected with investments, and supervise the implementation of the measures issued;

--prepare the academy's budget plan proposal in conformance with the research policy goals, then prepare detailed budget plans within the established budgetary limits, submitting it to the secretary general for approval and, based on the approved budget plan, take the necessary measures for economic operation to produce scientific results;

--within the limitations of the annual budget established for the academy, see to it that the budgets of the academy's institutions are prepared and, based on this, compile and publish a budget brochure;

--ensure the financial supplies of the economic operating organs supervised and supported by the academy, supervising and keeping records of the accounting work of the economic operating organs;

--prepare the academy's medium-range and annual renewal plans, submit the medium-range plan for the secretary general's approval, operate economically with the renewal financial means and the budget based on the approval, and supervise the renewal work done;

--handle the financial tools of the Central Research Fund, and ensure compliance with the financial specifications connected with the use of the fund;

--cooperate in the review of the economic chapter contained in the research plans of the academy's institutions, as well as in the evaluation of the financial chapter of the reports dealing with the operation of the institutions and their research activities;

--supervise the economic activity of the academy's institutions and supported economic operating organs with the cooperation of the main departments of the science branch; the supervisory function includes supervision [to insure] that the economic operation follow the rules and the law, protection of society's property, investigation of the activity of the institutions aimed at the utilization of idle supplies, etc.;

--comprehensively direct the academy's service institutions included in the budget, improving the level of services, and increasing the economy of operation;

--handle the directing and supervisory tasks related to supervising the academy's enterprises; multifaceted support to the successful operation and modernization of these enterprises;

--prepare the directives and measures related to the implementation of the wage and labor statutes in force, and supervising their implementation;

--keep records of the wage and labor statistics related to the assignment and appointment of the institute leaders under the appointment and assignment authorities of the academy's leaders;

--determine the support payments for relatives of deceased persons with scientific grades;

--keep records of the academy's expense and income projections, and handle ledger bookkeeping tasks;

--conduct the comprehensive implementation of the tasks defined in the budget, and the budgetary supervision aimed at implementing the rules (goal, topic and followup studies);

--regularly supply data to the secretary general, deputy secretaries general and office manager about the development of the academy's most important financial and employment indicators;

--handle the tasks related to labor protection and accident prevention within the framework of the labor-protection organization; and also the top-level authoritative tasks related to energy management;

--handle the tasks related to the relationship of the academy's institutions with the authorities;

--handle automobile matters by portfolio rules.

Paragraph 33

Tasks of the Administrative and Legal Main Department

(1) The Administrative and Legal Main Department handles general decision preparation, coordinating, controlling, information supplying, codification and other special legal, administrative and economic operating tasks.

(2) The main department's special tasks are:

--preparation of presentations and reports to be submitted by the academy to higher organs;

--preparation of the coordinating conference, the research policy council, the secretary general's conference, and the office manager's conference in the manner regulated by its special procedures, assemble the necessary records and reminders, and cooperate in the implementation of the decisions made;

--preparation of the legal remedy petitions for decision submitted against the resolution of the Scientific Qualifying Commission;

--development of the secretary general's directives and of the academy's orders issued in statute form, and publication of these after approval;

--handling the tasks related to state supervision and central recordkeeping of the scientific associations (societies);

--implementing portfolio-level youth-policy tasks;

--implementing the tasks which affect the Central Office in connection with economic mobilization, fire prevention and civil defense, and supervisory tasks;

--representing the academy in lawsuits and nonlawsuit procedures before the courts;

--cooperating in disciplinary and damage compensation matters and initiate penal procedures in case of a crime;

--preparing periodic publication of the collection of the secretary general's directives and of the academy's regulations;

--preparing the academy's (Central Office's) semiannual work plans according to the secretary general's guidance;

--handling the tasks of confidential case handling within the office, and perform the supervisory activity in the academy's institutions;

--ensuring the copying of case documents and of various other documents;

--regulating and supervising document-handling in the Central Office; organizing the safekeeping, recordkeeping, and destruction of documents according to specifications;

--organizing inside and outside delivery, and arrange for special delivery service for the academy's leaders;

--operating the welfare and social institutions and the academy's vacation homes and handle vacation matters; handle assignments into the Guest House; handle the memorial service matters of academicians; direct supervision of the Automobile Service and of the Scientist Club.

(3) The tasks of the Administrative and Legal Main Department in the immediate supervision of the organization which handles the economic (head bookkeeping) tasks of the Central Office, are:

--preparing the Central Office's budget, as well as handling the economic, wage payment and labor-related tasks connected with this;

--planning and satisfying the Central Office's needs for technical equipment and materials, and handle investments;

--operating the buildings and, within this, particularly ensure maintenance, heating, cleaning, etc.;

--handling labor safety tasks;

--providing the conditions for office work (administrative equipment, supplies, etc.).

Paragraph 34

Tasks of the Interkosmos Council Secretariat

(1) The Interkosmos Council Secretariat handles the preparatory, operative case-handling, and analytical tasks necessary to the activity of the inter-portfolio commission (Interkosmos Council) operating under the direct guidance of the adademy's secretary general, as an independent department of the Central Office.

(2) The secretariat's special tasks are to:

--prepare the council's sessions, develop the presentations and resolution drafts of the sessions, and conduct the sessions;

--prepare records of the council's sessions, keep records of the materials and resolutions of the sessions, supervise the implementation of the resolutions;

--coordinate the activities of the special commissions, follow their work with attention and regularly report to the chairman;

--take care that the use of the financial means provided for the operation of the special commissions is done in the authorized manner and in conformance with regulations, in cooperation with the Financial Main Department;

--in cooperation with the council's members, follow with continuous attention the domestic needs related to space-exploration results which can be used in the national economy;

--follow with attention the latest foreign results of space exploration, the directions of research, and regularly inform the affected organs about this;

--in the interest of providing public opinion with the proper information, extend assistance to scientific information-dissemination and mass-information institutions;

--participate in conducting events which serve the high-level scientific and political propagation of space-exploration activity;

--in harmony with the appropriate organs of the Foreign Ministry, maintain direct contact with the national coordinating organs of the countries which participate in the Interkosmos Program, as well as with the other national and international organs affected by the work of the Interkosmos Program;

--follow domestic space-exploration activity with continuous attention, and prepare information for the international organizations, coordinating it with the Foreign Ministry.

Paragraph 35

Tasks of the Scientific Corporate Secretariat

(1) Under contentual guidance by the academy's chairman and vice-chairmen--and with respect to the scientific departments, of the department chairmen--the Scientific Corporate Secretariat handles the preparatory, organizing and administrative work needed for the operation of the scientific bodies (the general assembly, the presidium, the scientific departments, scientific commissions, regional academic and other presidential commissions).

(2) The special tasks of the Scientific Corporate Secretariat are to:

--Take care of preparing and conducting the general assembly, the presidium's sessions, departmental meetings and other corporate events, reduce their resolution drafts into writing, and organize the implementation of the resolutions;

--cooperate in the preparation of corporate positions related to the national scientific research plans and to other concepts which serve the fulfillment of the country's socioeconomic needs;

--take care that the financial tools furnished to implement the corporate tasks are used in the authorized manner and according to the rules;

--prepare and organize the operation of permanent and ad hoc corporate committees;

--cooperate in familiarization with domestic and foreign scientific results, in the development of new scientific directions, preparation of opinion-search work related to domestic scientific research, in the development of corporate positions, in the preparation of scientific position evaluations and prognoses, and in the development of proposals for introducing new scientific results into practice;

--participate in the preparation of rendering opinions about dissertations submitted to win the doctor of sciences degree, and in defining the corporate position;

--cooperate in the preparation of opinions on submissions for university professorships and lecturerships, as well as for college professorships, and in defining the corporate position;

--cooperate in the preparation of the academy's annual and medium-range book and magazine publishing plans and in solving the problems which occur during the course of the publishing activity;

--cooperate in preparing and conducting the reelection of the corporate organs;

--handle the support of scientific societies with respect to the content of scientific and opinion-rendering work;

--cooperate in the preparation and implementation of the tasks falling onto the scientific areas from international cooperation;

--take care of conducting the competitions announced by the corporations and by their leaders;

--take care of assembling the corporate proposals concerning decorations awarded by the state;

--follow with continuous attention the implementation of higher level regulations to which the corporations are subject;

--handle all those tasks which the leaders of the corporations or the academy assign to it.

(3) Within the organization of the Scientific Corporate Secretariat, there are departmental secretariats which correspond to the scientific departments; these perform the necessary organizing and administrative work for the corporate activities of the corresponding scientific departments.

(4) The appropriate workers of the main departments of the scientific branches participate in the secretary's conferences held within the framework of the Scientific Corporate Secretariat.

(5) The departmental secretariats operating within the Scientific Corporate Secretariat are:

Secretariat of the Language and Literary Sciences Department
Secretariat of the Department of Philosophical and Historical Sciences
Secretariat of the Department of Mathematical and Physical Sciences
Secretariat of the Department of Agricultural Sciences
Secretariat of the Department of Medical Sciences
Secretariat of the Department of Technological Sciences
Secretariat of the Department of Chemical Sciences
Secretariat of the Department of Biological Sciences
Secretariat of the Department of Economic and Legal Sciences
Secretariat of the Department of Geological and Mining Sciences.

Paragraph 36

Tasks of the Secretariat of the Scientific Qualifying Commission

(1) The organizational, economic operating and administrative activities of the Scientific Qualifying Commission [TMB] are handled by the Secretariat of the TMB (hereinafter: secretariat) operating within the framework of the Central Office.

(2) The tasks of the secretariat are scientific qualification: to follow with attention and analyze the domestic and foreign experiences of researcher training, and to initiate further developments in scientific qualification and researcher training.

(3) In matters connected with the training of foreign citizens and researcher training abroad, the secretariat maintains contact with the appropriate organs of the Foreign Ministry, and with the foreign representations.

(4) The secretariat's special tasks are to:

--prepare or to have prepared presentations, analytical reports, concepts, and information for the TMB's plenary session and for the higher organs;

--prepare the meetings of the TMB and of its corporate organs, and the cases for the sessions;

--implement the resolutions of the TMB and its corporate organs;

--submit appeals filed against the decisions of the TMB and its corporate organs to the academy's chairman or to the TMB, respectively;

--handle the affairs of the domestic and foreign postgraduate students doing research work for higher degrees, as well as those studying abroad, in academic, social, labor and other matters;

--develop the TMB's budget plan, operate economically within the budget and prepare the specified as well as the necessarily occurring economic reports, analyses and accountings;

--collect procedural and test fees, production costs of theses, pay scholarships, salary supplements, honoraria, assistances and benefits, and ensure the expenses for educational travel;

--issue the diploma attesting to scientific grades, and the final certificates of postgraduate students who earned higher degrees by doing research work;

--keep personnel records connected with scientific qualification and postgraduate research work leading to higher degrees, keep records of doctorates, candidature, and aspirants, and take care of the required statistical record-keeping and data distribution.

Paragraph 37

Personal secretariats

Personal secretariats (offices) may operate under the immediate supervision of leaders of the academy (chairman, secretary general, vice chairmen and deputy secretaries general) in which the number of people working is determined by the secretary general on the basis of the proposal of the leader in question concerning the tasks of the job area and the order of operation.

Chapter VIII: Miscellaneous Orders

Paragraph 38

(1) Based on the Organizational and Operational Regulation, all main departments must prepare detailed regulations and the job descriptions of the main department's employees.

(2) Regulations of the main departments are approved by the appropriate deputy secretary general, or by the office manager.

(3) One copy of the approved regulations and of the job descriptions must be sent to the Administrative and Legal Main Department.

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